Final Specialist Report for the Malheur Invasive Plant Treatment DEIS

Range

Prepared By

Kat Carsey, Botanist

TEAMS Enterprise Unit

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Prepared by: Kat Carsey **April 29, 2014**

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Introduction

In 2005, Region 6 completed an EIS and Record of Decision (ROD) (R6 ROD 2005) for Preventing and Managing Invasive Plants. The new direction provided by this regional document is to facilitate the elimination or to control invasive plants, as provided in 23 standards for prevention and management. The document did not approve any site specific projects which is the purpose of the Malheur National Forest Invasive Plant Treatment EIS. The analysis in this report tiers to the R6 2005 FEIS and ROD. Site specific treatment decisions will be based on location and size of the target invasive plant occurrences, site conditions and integrated resource objectives.

This report analyzes the effects of proposed actions to range resources, with emphasis on the herbicide treatments proposed and evaluates how well the proposed alternatives meet the purpose and need in relation to range resources.

Overview of Issues/Elements of the Purpose and Need Addressed

Issues from Chapter 1 that are relevant to range resources:

- *Herbicide use can be toxic to people and the environment (would include livestock).*

Issue Indicators

Indicators used to disclose the differences between alternatives are:

1. *Type and extent of herbicide use that could result in harmful exposure scenarios to livestock*

Different herbicides have different chemical properties and different potentials for resulting in harmful effects to livestock or range administration.

2. *Amount of time and area of livestock restrictions during and after herbicide use*

Some herbicides require removing livestock from areas to be sprayed. These restrictions would affect range administration.

3. *Qualitative assessment of the effectiveness of buffers and other project design features to prevent harmful herbicide exposure scenarios*

This measure assesses the extent to which buffers and design features are adequate to protect livestock from potential harmful effects of herbicide.

4. *Assessment of treatment costs and effectiveness*

The predicted effectiveness of the alternatives provides a measure of the amount of time it would take to see reductions in invasive plants and restoration of the native vegetation that provides forage for livestock use. The cost of alternatives may affect the amount of treatment that occurs in a given year, and therefore, also provides a measure of the amount of time it would take to reduce invasive plant infestations and begin the restoration of native vegetation. Greater effectiveness and lower costs would correspond to faster invasive plant reductions and shorter time periods for native vegetation to recover and provide forage for livestock.

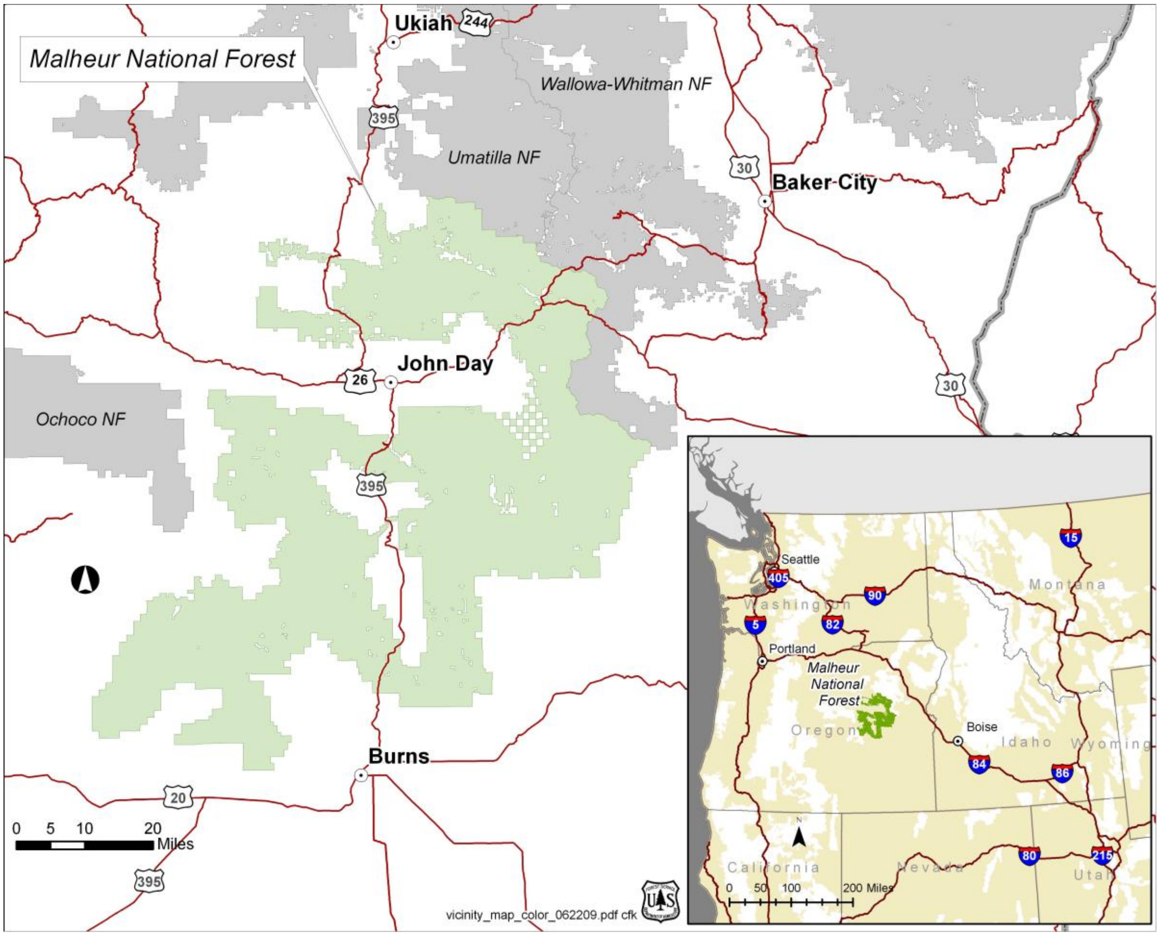

Figure 1. Vicinity map for the Malheur National Forest Invasive Plant Treatment Project

Regulatory Framework

The Region 6 FEIS and ROD recognize that invasive plants lead to many adverse environmental effects, including a reduction in forage for livestock. Under the ROD, grazing allotment management plans address prevention, establishment, and spread of invasive plants. Prevention and treatment standards outlined in the ROD which affect range management actions for the Malheur National Forest are listed in Table 1.

Goals for invasive plant treatment include (R6 FEIS 2005):

Goal 1 - Protect ecosystems from the impacts of invasive plants through an integrated approach that emphasizes prevention, early detection, and early treatment.

Goal 2 - Minimize the creation of conditions that favor invasive plant introduction, establishment and spread during land management actions and land use activities.

Goal 3 - Protect the health of people who work, visit, or live in or near National Forests, while effectively treating invasive plants.

Goal 4 – Implement invasive plant treatment strategies that protect sensitive ecosystem components, and maintain biological diversity and function within ecosystems.

Goal 5 – Expand collaborative efforts between the Forest Service, our partners, and the public to share learning experiences regarding the prevention and control of invasive plants, and the protection and restoration of native plant communities.

Table 1. Range management standards specific to the Malheur National Forest Invasive Plants Treatment EIS (from R6 ROD, 2005)

2005 ROD Prevention and Treatment Standards and Range Management		
Standard	**Related to Range Management Practices**	**Application**
Prevention Standard 1	Prevention of invasive plant introduction, establishment and spread will be addressed in grazing allotment and vegetation management plans.	Include direction from Forest LRMP, the 2001 Guide to Noxious Weed Prevention Practices, and the 2005 ROD.
Prevention Standard 2	Actions conducted or authorized by written permit by the Forest Service that will operate outside the limits of the road prism . . . require the cleaning of all heavy equipment … prior to entering National Forest System Lands.	Private lands associated with permittees are periodically surveyed to determine the presence of invasive species and the need for washing of vehicles such as water trucks and ranch vehicles before entry onto National Forest System Lands. Water trucks are generally restricted to roads or "haul routes" that like roads are compacted and disturbed. Destinations are water set areas used year after year.
Prevention Standard 3	Use weed-free straw and/or mulch for all projects, conducted or authorized by the Forest Service, on National Forest System Lands. If State certified straw and/or mulch is not available, individual Forests should require sources certified to be weed free using the North American Weed Free Forage Program standards (see Appendix O) or a similar certification process.	Where straw and/or mulch may be used as bedding for livestock operations and/or restoration projects.
Prevention Standard 4	Use only pelletized or certified weed free feed on all National Forest System Lands. If State certified weed free feed is not available, individual Forests should require feed certified to be weed free using	Would phase in the use of weed free feed by permittees on all allotments over time including hay. Hay and other feeds are

2005 ROD Prevention and Treatment Standards and Range Management		
Standard	Related to Range Management Practices	Application
	the North American Weed Free Forage Program standards or a similar certification processes Choose weed-free project staging areas, livestock and packhorse corrals, and trailheads.	occasionally used to gather or attract livestock, generally in preparation for a move. Would have permittees avoid those areas that become infested with invasive plants for livestock operations such as gather, herding, the staging of vehicles and livestock watering. The bigger concern would be where the permittee transports horses onto the allotment and brings hay products in with the trailer or if the permittee stays overnight and feeds horses at a line camp.
Prevention Standard 5	Retain native vegetation consistent with site capability and integrated resource management objectives to suppress invasive plants and prevent their establishment and growth.	Compliments CDO. Land and resource management plans standards and guidelines that call for maintaining or improving vegetation conditions on allotments.
Prevention Standard 6	Use available administrative mechanisms to incorporate invasive plant prevention practices into rangeland management. Examples of administrative mechanisms include, but are not limited to, revising permits and grazing allotment plans, providing annual operating instructions, and adaptive management. Plan and implement practices in cooperation with the grazing permit holder.	Accomplished long term through environmental analysis projects that lead to new allotment management plans and grazing permits. Cooperate with grazing permittee on an annual basis to incorporate invasive species prevention practices in annual operation plans and use adaptive management to recognize changing science and ecosystem conditions.
Treatment Restoration	Prioritize infestations of invasive plants for treatment at the landscape,	Provides an opportunity to focus on local problem

2005 ROD Prevention and Treatment Standards and Range Management		
Standard	Related to Range Management Practices	Application
Standard 11	watershed or larger multiple forest/multiple owner scale.	areas and establish “community” based solutions that might include, but is not limited to, multiple ranches, state and/or BLM lands.
Treatment Restoration Standard 23	Prior to implementation of herbicide treatment projects, National Forest system staff will ensure timely public notification. Treatment areas will be posted to inform the public and forest workers of herbicide application dates and herbicides used. If requested, individuals will be notified in advance of spray dates.	Permittees will be notified upon request of specific treatments dates. Permittees will be notified of invasive plant treatment areas and the potential for treatment by herbicides as needed on an annual basis. The most appropriate method would be during annual operating meetings.

Affected Environment

Existing Condition

Invasive plants have been detected on approximately 2,124 acres (approximately 0.1%) of the 1.7 million-acre Malheur National Forest located in Eastern Oregon. Although they are a small proportion of the vegetation on the Malheur National Forest, invasive plants are likely to continue spreading rapidly and have the potential to displace or alter native plant communities and cause long-lasting ecological and economic problems within and outside the National Forest. Direct impacts of invasive species to grazing animals include nitrate poisoning from Canada thistle in ruminants, fatal poisoning of horses from Russian knapweed and yellow starthistle, excessive salivation and diarrhea in cattle from leafy spurge, and liver problems in livestock, particularly horses and cattle from houndstongue and tansy (CDA 2009, James et al. 1992, USDA Forest Service 2012b, USDA Forest Service 2012c). Presently, 18 invasive target plant species in 3,070 sites (GIS polygons) are known to occur within the Forest. Additional invasive plant sites likely exist but have not yet been detected by inventory and mapping efforts. Invasive plants are scattered throughout the infested areas with density ranging from less than 10 percent to 100 percent of the primary target species. Appendix A lists numbers and acres of infested sites by Ranger District and allotment.

Domestic and wild grazing animals contribute to invasive plant establishment and spread through selective eating, redistribution of invasive plant seeds in scat, skin, fur and/or hooves, and soil disturbance that create conditions favorable for seed germination. Historically, several intentional and unintentional introductions of invasive plants into native plant communities have been associated with livestock management, resulting in widespread invasions (DiTomaso 2000; Sheley et al. 1999).

Since 2002 the Malheur National Forest has been enjoined from treating invasive plants with herbicides or biocontrol agents (*Blue Mountain Biodiversity Project v. US Forest Service*, CV 01-703-HA). The Forest staff have been treating invasive plants exclusively using manual or mechanical methods on the Malheur National Forest.[1] Manual and mechanical treatments are labor intensive and tend to be costly, and in some cases are not effective. The Forest is unable to effectively treat current infestations or respond quickly to new infestations with these methods. Monitoring and subsequent weed mapping has proven this approach unsuccessful because invasive species continue to spread across the Forest. Projected rate of spread in the region is estimated at 8 to 12% per year (USDA Forest Service 2013).

Management direction for invasive plant prevention, treatment and restoration, and monitoring was added to the Malheur Forest Plan as a result of the Record of Decision for the Pacific Northwest Region Invasive Plant Program: Preventing and Managing Invasive Plants (R6 2005 ROD) (R6 FEIS 2005). The R6 2005 ROD describes the reasons why specific management direction was adopted and why alternative strategies (to increase herbicide use or increase emphasis on prevention) were not adopted. These discussions are summarized and incorporated where relevant; however the decisions made in 2005 are not being reconsidered here. The action alternatives considered in this EIS are intentionally limited in scope to options for implementing updated, effective invasive plant treatments in accordance with the R6 2005 ROD.

Monitoring on the Malheur National Forest has shown increases in invasive plant populations. Though some invasive plant sites have been successfully contained or controlled, new sites have been identified and many existing sites have grown. This along with the identification of new species and the increase of invasive plant introductions has limited the application and effectiveness of manual, mechanical and biocontrol methods of treatment. In the past the forest has treated 400 acres at most, with an average of 139 acres and a median 100 acres annually between 2000 and 2012.

Additional invasive plant sites likely exist but have not yet been detected by annual inventory and mapping efforts. Some species, such as cheatgrass (*Bromus tectorum*), North Africa grass (*Ventenata dubia*) and Canada thistle (*Cirsium arvense*) may occur in such abundance that many sites on some districts have not been mapped based on species priority levels determined at the district level. In some cases, these species may be considered as low priority for treatment due to priorities and/or monetary constraints or species naturalization.

Current Trends

Presently more than 99% of the Malheur National Forest is appropriated into cattle grazing range allotments (1,695,228 acres, based on GIS data for the Malheur National Forest). The Malheur National Forest administers 106 grazing allotments, of which 98 are active and 8 are vacant. There are currently invasive plant infestations mapped on 86 of these allotments (81%) including on 5 of the vacant allotments. Infested sites range in size from one plant to numerous plants scattered over large acreages. Over 90 percent of inventoried sites are less than one acre in size and an additional one percent of the sites are less than five acres in size.

[1] Herbicides have been used in spot treatments totaling 10-20 acres/year along roads on the Snow Mountain Ranger District portion of the Emigrant Creek Ranger District – Ochoco National Forest, as authorized under the Ochoco National Forest Plan Amendment # 16, which is outside the area covered by the injunction. Biological agents have been released adjacent to the Malheur National Forest boundaries and have occupied some widespread host species such as toadflax and St Johnswort.

Table 2. Invasive weed acres presently identified within active and vacant allotments

Allotment Use	Allotment acres	Invasive weed acres	% of Allotment acreage occupied by Invasives	% of Total Forest Land base infested with Invasives
Active	1,614,599	1682	0.1	0.09
Vacant	80,629	442	0.5	0.03
Total	**1,695,228**	**2124**	**0.60**	**0.12**

Table 3. Acres of invasive plants in grazing allotments by species

Invasive species	Estimates of Total Acres infested[1]
Bull thistle (*Cirsium vulgare* (Savi) Ten).	
Canada thistle (*Cirsium arvense* (L.) Scop.)	1020.92
Common St. Johnswort (*Hypericum perforatum* L.)	120.42
Dalmatian toadflax (*Linaria dalmatica* (L.) Mill.)	155.29
Diffuse knapweed (*Centaurea diffusa* Lam.)	73.86
Houndstongue (*Cynoglossum officinale* L.)	339.55
Leafy spurge (*Euphorbia esula* L.)	9.97
Meadow knapweed (*Centaurea jacea* L)	0.28
Musk thistle (*Carduus nutans* L.)	11.29
Perennial pepperweed (*Lepidium latifolium* L.)	2.29
Russian knapweed (*Acroptilon repens* (L.) DC.)	4.01
Scotch thistle (*Onopordum acanthium* L.)	23.39
Spotted knapweed (*Centaurea stoebe* L. ssp. *micranthos* (Gugler) Hayek)	81.56
Squarrose knapweed (*Centaurea virgata* Lam. ssp. *squarrosa* (Willd.) Gugler)	0.33
Sulfur cinquefoil (*Potentilla recta* L.)	186.16
Whitetop (*Cardaria draba* (L.) Desv.)	84.59
Yellow starthistle (*Centaurea solstitialis* L)	1.21
Yellow toadflax (*Linaria vulgaris* Mill.)	8.63
Total	**2124**

[1] These acreages are gross acres where areas are delineated by the outer perimeter of the weed infestation and may contain significant areas that are not currently occupied by weeds.

Canada thistle, Dalmatian toadflax, and houndstongue are the most abundant and widespread invasives in range allotments. Common St; Johnswort, diffuse knapweed, and whitetop are fairly abundant and occur on all three districts. Five species (leafy spurge, spotted knapweed, squarrose knapweed, sulfur cinquefoil, and yellow starthistle) have been reported only on the Blue Mountain district. The invasive weed acres are reported as gross acres infested without reference to density or cover within the site; the invasive species may be scattered within a site.

Weed spread

Seed dispersal for many species, including diffuse knap weed,, Canada thistle. scotch thistle and whitetop, is largely by wind (Bullock and Clarke 2000, CWMA 2007, USDA Forest Service 2012a, USDA Forest Service 2012b, Zouhar 2004), however, seeds can also be spread by vehicles, water transport and animals (fur, hooves, and gastrointestinal ingestion and redistribution). See table 4 for more on dispersal vectors. In many instances cattle and other grazers will avoid areas where invasive weeds are prevalent in large monocultures and move to areas where there is better forage. In areas where invasive species are interspersed with desirable forage, it is likely that seeds would either attach to fur or mud on hooves or be ingested and dispersed in feces. Some weed seeds are destroyed within the gastrointestinal tract; however, leafy spurge and spotted knapweed seeds can pass through sheep, goats, and mule deer and some of the seeds remain viable (Lacey et al. 1992). Leafy spurge seed was shown to be viable in feces 10 days post ingestion by mule deer. Long-lived seeds and hard seeded species of dicots and grasses consumed by grazers have been reported to survive passage through gastrointestinal tracts of cows and grizzly bears (Janzen 1984).

Cattle behavior along fence lines and around water developments can result in disturbed areas for invasive species to establish. According to available information, there are fewer than 3 miles of fenceline on allotments and just over 4 acres of invasive plants within 10 feet of fencelines. This would indicate that there is a high potential for weed spread from cattle trailing along fencelines on 3.25 acres. Five water developments are mapped as having invasive plants within 25 feet. Cattle disturbance around these water developments may be estimated to result in less than one acre of weed spread. These estimates suggest that cattle grazing may have a lower potential to affect the spread of invasive plants than some other vectors (Table 4). However, not all fencelines and water developments are mapped, so these estimates may be lower than actual potentials, and cattle may spread seed into bare soils created by other types of disturbance.

Roads are generally considered important vectors for the spread of invasive species (Birdsall 2011, Gelbard and Belnap 2003, Hansen and Clevenger 2005). On the Malheur National Forest, 55 percent of infested acres and 73 percent of infested sites are within 50 feet of roads. Seventy percent of infested acres and 81 percent of sites[1] are within 100 feet of roads. Acres of invasive species within 100 feet of a road total 1,491acres.

Table 4 lists more vectors for weed spread.

Table 4. Risk for invasion by disturbance frequency, intensity and propagule pressure from noxious weeds.

Vector	Disturbance Frequency/ Potential Maximum Intensity	Potential Propagule Pressure	Most Applicable R6 Management Direction/ Prevention Considerations
Recreation sites management, dispersed and developed sites; campgrounds, hunter camps, trailheads.	Perpetual/Low	High	R6 Goal 1, Objectives 1.2; 2.4, 2.5; Standards 1, 4; outreach and education, travel management, recreation management
Livestock grazing; Dry open grassland steppe, shrub lands, dry forestlands	Seasonal/Moderate to High	Moderate to High	R6 Goals 1, 2; Objectives 1.2, 2.1, 2.2; Objective 5.3; Standards 4,6; AMPs and annual operating plans,
Vegetation management (thinning	Periodic/High (especially yarding	High	R6 Goals 1,2; Objectives 1.1, 2.1, 2.2, Standards 1, 2, 3, 13

Vector	Disturbance Frequency/ Potential Maximum Intensity	Potential Propagule Pressure	Most Applicable R6 Management Direction/ Prevention Considerations
and brushing, logging, burning)	corridors and landings, pile burning)		Covering disturbed sites, particularly small burn areas, with fine to medium sized organic matter may prevent or reduce the size of some infestations, such as Canada thistle (see table 8).
Wildland fire and incident response	Periodic/Low to High	Moderate	R6 Goals 1, 2; Objectives 1.1, 1.3, 1.5 2.3; Standards 1, 2*, 3, 13 *although emergency situations like wildland fire are explicitly exempt from this equipment cleaning standard, Forests report that it happens routinely.
Roads (road maintenance, construction, reconstruction and use)	Perpetual/High	High	R6 Goals 1,2; Objectives 1.1, 2.4, 2.5; Standards 1, 2, 7, 8, 13 Forests report excellent coordination with engineering staff , quarries are inspected and road materials are weed free
Closing roads	Periodic/Low	Moderate	R6 Goal 2; Objective 2.4; Standards 1, 2, 3, 13
Restoring roads and landings	One time/ Low to High	Moderate	R6 Goals 1, 2; Objective 1.1; 2.1, 2.4; Standards 1, 2, 3, 13
Adjacent agriculture	Perpetual/Low	Low	R6 Goal 5; objectives 5.1-5.3
Stream restoration (i.e., fish passage and habitat projects, riparian vegetation restoration), Stream flow	Seasonal/High	Low	R6 Goals 1, 2; Objectives 1.1, 1.3, 1.5, 2.1, 2.2; standards 1, 2 Keep equipment working near streams clean.
Mining, Minerals Exploration	Low to High	Low	R6 Goals 1, 2; Objectives 1.1, 1.2, 2.1, 2.2, Standards 1, 3, 13

Table 5 shows invasive plant species sites by Ranger District. Table 6 shows the acreage of invasive species by Ranger District.

Table 5. Number of invasive plant species sites identified on each district within the Malheur National Forest

Common Name	Districts		
	Blue Mountain	Emigrant Creek	Prairie City
Bull thistle[1]	NA	NA	1
Canada thistle	404	536	336
Common St. Johnswort	146	5	34
Dalmatian toadflax	185	285	196
Diffuse knapweed	97	27	89
Houndstongue	22	26	123
Leafy spurge	14	0	0
Meadow knapweed	1	0	1
Musk thistle	11	0	2
Perennial pepperweed	3	7	2
Russian knapweed	10	33	0
Scotch thistle	33	4	24
Spotted knapweed	131	22	18
Squarrose knapweed	3	0	0
Sulfur cinquefoil	58	2	1
Whitetop	43	92	13
Yellow starthistle	3	0	0
Yellow toadflax	20	5	2
18 Species	**1184**	**1044**	**2**

[1]Often mapped with Canada thistle

Table 6. Acres[1] of invasive plant species identified on each district within the Malheur National Forest

Common Name	Districts		
	Blue Mountain	Emigrant Creek	Prairie City
Bull thistle[2]	NA	NA	NA
Canada thistle	675.52	246.73	98.67
Common St. Johnswort	115.54	0.50	4.38
Dalmatian toadflax	36.42	67.09	51.78
Diffuse knapweed	46.98	3.91	22.97
Houndstongue	164.78	6.54	168.23
Leafy spurge	9.97	0	0
Meadow knapweed	0.10	0	0.18
Musk thistle	8.34	0	2.95
Perennial pepperweed	0.32	1.30	0.67
Russian knapweed	1.08	2.93	0
Scotch thistle	17.48	0.41	5.50

Spotted knapweed	72.16	3.61	5.79
Squarrose knapweed	0.33	0	0
Sulfur cinquefoil	181.54	0.20	4.42
Whitetop	24.18	55.43	4.93
Yellow starthistle	1.21	0	0
Yellow toadflax	2.76	5.51	0.36
18 Species	**1359**	**394**	**371**

[1]Acres are approximate.

[2]Often mapped with Canada thistle

Native Vegetation

The Malheur National Forest located in east central Oregon contains a wide diversity of plant species and communities due to varying elevation and precipitation zones that occur within eastern Oregon. The 1.7 million plus acre forest lies within Baker, Crook, Grant, Harney, and Malheur counties in Oregon. Elevations on the Forest vary from 3,900 feet (at the Forest boundary south of Mt. Vernon, Oregon) to 9,038 feet on Strawberry Mountain. The result is a diverse and productive landscape of grasslands, sage, and juniper; forests of pine, fir and other tree species, and mountain lakes and meadows. Given this combination of physiography and climate, habitats are highly variable and retain a legacy of botanical diversity. Table 7 lists potential vegetation groups on the Malheur National Forest. The groups are aggregations of plant associations and represent a combination of temperature and moisture regimes for the Malheur National Forest.

Since the time of the first movement of people into the area and the associated establishment of invasive weed spread vectors (highways, railroads, canoes, rafts, and other transportation methods), invasive plants have altered habitats and vegetation types across the landscape. For example, many areas within the forest have become permanently altered by annual grasses, which have become naturalized. In certain instances this permanent alteration of habitat has affected native vegetation (Olson 1999). Eastside forests are more susceptible to invasive plants than other forests in the region (R6 FEIS 2005). In general, their grasslands, riparian areas, and relatively dry, open forests are more susceptible to invasion than are dense moist forests and high montane areas (R5 FEIS 2005). The grasslands, riparian areas, and relatively dry, open forests have frequent gaps in the plant cover, which favor invasive plant establishment. The moist forests and high montane areas have relatively closed plant cover or have extreme climate or soils, which are tolerated by fewer invasive plant species. Invasive plants tend to colonize disturbed ground along and around developments such as roads, highways, utility (powerline) corridors, recreational residences, trails, campgrounds and quarries. These are all places where native vegetation has been removed and disturbance has created areas for invasive plants to establish.

Plant communities can be classified by a variety of factors such as vegetation structure, site moisture, overstory, and understory. The 2005 FEIS used broad potential vegetation groups (PVGs) to rate the susceptibility of vegetation to invasive plant establishment. Table 7 provides a summary of the PVGs found in the MalheurNational Forest, their susceptibility to damage from invasive plants, the local plant community types that correspond to these broad PVG types, and mapped acres of invasive plants within the plant community types. The susceptibility of plant communities to invasion can be influenced by many factors, including disturbance levels, community structure, and the biological traits of the invader species. Overall, most plant community types found on the Malheur National Forest are moderately to highly susceptible to invasion.

Table 7. Potential Vegetation Groups on the Malheur National Forest's 1.7 million acres and their susceptibility to invasive plants

Potenial Vegetation Group	% of Forest	Susceptibility to Invasion[1]	Infested acres (all species)[2]
Cold forest	2	Moderate	5
Cold herbland	0.1	Moderate	0.1
Cold shrubland	0.2	Moderate	0.3
Cool-cold riparian forest	0.000007	Moderate-high	0
Cool-cold riparian herbland	0.0002	Moderate-high	0.06
Dry Douglas-fir forest	16	Moderate-high	290
Dry grand-fir forest	24	Moderate-high	503
Dry ponderosa pine forest	21	Moderate-high	457
Hot-dry pine forest	10	Moderate-high	136
Dry herbland	2	High	29
Dry shrubland	6	High	43
Juniper woodland	3	Moderate-high	28
Moist forest	13	Moderate-high	456
Moist herbland	0.55	Moderate-high	18
Moist shrubland	0.8	Moderate	29
Warm-hot riparian herbland	1	High	74
Warm-hot riparian forest	0.00003	Moderate-high	0.3
Warm-hot riparian shrubland	0.0009	High	26
Whitebark pine forest	0.4	Moderate-high	0.4
	100.0		

[1] Susceptibility ratings (derived from R6 FEIS): High = high susceptibility to invasion. Invasive plant species invades the cover type successfully and becomes dominant or co-dominant even in the absence of intense or frequent disturbance; Moderate = moderate susceptibility to invasion. Invasive plant species is a "colonizer" that invades the cover type successfully following high intensity or frequent disturbance that impacts the soil surface or removes the normal canopy; Low = low susceptibility to invasion. Invasive weed species does not establish because the cover type does not provide suitable habitat.
[2]Some mapping error due to overlap in species occurrences in duplicate potential vegetation groups in GIS database

Desired Condition

From R6 ROD: In National Forest lands across Region Six, healthy native plant communities remain diverse and resilient, and damaged ecosystems are being restored. High quality habitat is provided for native organisms throughout the region. Invasive plants do not jeopardize the ability of the National Forests to provide goods and services to communities (R6 ROD 2005).

The desired conditions for invasive plant species and range resources from management direction established by the Malheur Forest Plan (USDA Forest Service1990):

1999: Protect resource values through the practice of integrated pest management.

By 1999, modified grazing strategies will have been applied to selected allotments which will increase the rate of improvement in the riparian vegetation. Some will be showing dramatic improvement by the end of the decade. Other riparian areas within allotment pastures will also show improvements due to reduced utilization of grasses and shrubs. Woody shrubs will be more prevalent. Some existing gullies will have been treated and as revegetation occurs erosion will be reduced. Ninety allotment management plans will be updated within the decade.

By 2039 management of most of the 1,351,275 acres of available suitable livestock range on the Forest will include full utilization of forage available for livestock during the growing season. All allotments will have exterior boundary fences in place and more subdivisions (pastures). Adequately designed water developments will have been installed and functioning to obtain relatively uniform cattle distribution, use of forage, and maintenance of plant vigor.

Environmental Consequences

The Malheur Invasive Plants Treatment Project analyzes four alternatives: The No Action (Alternative A), the proposed action (Alternative B), an alternative that reduces herbicide treatment and eliminates picloram (Alternative C), and the action alternative without aminopyralid (Alternative D). See Chapter 2 of the project EIS for a complete description of the alternatives.

The treatment area consists of 3,070 sites that cover 2,124 acres. Roughly 95 percent of the sites have infestations smaller than 1 acre. Herbicides would be sprayed using backpack sprayers, brush, hose or booms. Both alternatives B and D propose broadcast spraying. Aerial spraying is not proposed for any alternative.

Methodology

The analysis focuses on herbicide application since this is the highest risk of the proposed actions. The analysis addresses effects of herbicide use to livestock and the need for livestock to be restricted during and after herbicide use.

Issues Addressed

- Herbicide use can be toxic to people and the environment (would include livestock).

Issue Indicators

1. Type (rate, method, chemical properties) and extent of herbicide use that could result in harmful exposure scenarios to livestock
2. Amount of time and area where livestock may need to be restricted during and after herbicide use
3. Qualitative assessment of the effectiveness of buffers and other project design features to prevent harmful herbicide exposure scenarios
4. Assessment of treatment costs and effectiveness

This analysis tiers to the 2005 R6 Invasive Plant FEIS for information on general risks of herbicide use. A primary focus of this site-specific analysis was developing Project Design Features (PDFs) to insure compliance with standards introduced by R6 as well as Malheur National Forest Plan standards and guidelines. Risk assessments by the Syracuse Environmental Research Associates, Inc, (SERA 2001, 2004a-d, 2007, 2011a-d) contracted by the U.S. Forest Service and herbicide product labels were used to identify pertinent characteristics of herbicide chemicals. This information was applied to the project area circumstances to develop design criteria for minimal effects from treatment.

Incomplete and Unavailable Information

Numerous inventories of invasive plant species have been conducted on the Malheur National Forest , but since infestations sizes and locations constantly change through expansions, range extensions, or reductions due to treatment, numbers of sites and acres of infestations are the best available, but are approximate. Both the GIS database and the INFRA database are continually updated. In some cases, the information for range allotments in the two databases does not match.

Spatial and Temporal Context for Effects Analysis

The spatial boundary for the direct and indirect effects analysis is the project area. The cumulative effects spatial analysis area is the Malheur National Forest and nearby adjacent private, state and other federal lands. The time frame of the analyses includes the past 20 years and the next 15 years which is expected to be the life expectancy of this document. Invasive species have been present and programs existed on the forest for the past 20 years. However, most Land Resource Management Plans in the late 1980s and early 1990s did not recognize specific details of the ecologic implications of invasive plants.

Assumptions

The following assumptions were used in the analysis:

- The analyses and decisions made in the record of decision for the *HNF Weed Treatment Project Final Environmental Impact Statement* (R6 FEIS 2005) are incorporated in noxious weed analysis and management on the HNF.
- Any soil disturbing activity has the potential to increase noxious weed invasion or spread.
- The expected rate of spread of invasive plants is between 8 and 12 percent (USDA Forest Service 2013). With effective treatment the rate may be reduced to as low as 4 percent.
- The amount and extent of invasive plants continually changes as infestations expand or decrease in size with treatment.
- New invasive species may be introduced at any time.
- The Malheur National Forest databases provide the best available on weed infestations and range resources.
- All infested sites are covered with 100 percent invasives for this analysis (because density is such a rapidly changing and unpredictable variable).
- Treatment with the full range of tools would result in 80 percent fewer infested acres each year of treatment.

Project Design Features for Range Resources under all Action alternatives (from the EIS, Chapter 2):

N2: Permittees will be notified of annual treatment actions at the annual permittee operating plan meeting, and/or notified within 2 weeks of planned treatments of infestations > 1 acre in size.

N3: Follow most current EPA herbicide label for grazing restrictions.

H7. Lakes and Ponds – No more than half the perimeter or 50 percent of the vegetative cover within established buffers or 10 contiguous acres around a lake or pond would be treated with herbicides in any 30-day period. This limits area treated within riparian areas to keep refugia habitat for reptiles and amphibians.

H8. Wetlands – Wetlands would be treated when soils are driest. If herbicide treatment is necessary when soils are wet, use aquatic labeled herbicides. Favor hand/selective treatment methods where effective and practical. No more than 10 contiguous acres or fifty percent individual wetland areas would be treated in any 30-day period.

H9. Herbicide use would not occur within 100 feet of wells or 200 feet of spring developments. For stock tanks located outside of riparian areas, use wicking, wiping or spot treatments within 100 feet of the watering source.

Effects Analysis

This section will present the direct and indirect effects analysis for range resources for each alternative. Determination of effects are based on the implementation of all PDFs as listed in Chapter 2 of the EIS and all standards outlined in the Regional FEIS.

The Region 6 FEIS 2005 amended the existing Forest Plan, therefore, all action alternatives require incorporation of invasive plant prevention practices in annual operating instructions/plans and allotment management plans. The incorporation of these prevention practices are expected to reduce environmental impacts of cattle grazing forest wide. The effects analysis described in this document analyzes the effects of the alternatives on grazing allotment administration and range resources (livestock and forage). As Project Design Features prevention standard N2 requires, adjustments suggested to protect range resources would be addressed through existing administrative mechanisms such as grazing allotment management plans and grazing permits. Suggestions to address invasive plants or potential introduction may include:

- Changes in livestock movement patterns that require additional labor or may reduce outputs for certain allotments
- Alterations to season of use (length, turn-on, turn-off, etc.) and intensity of use that could reduce outputs and could include resting of pastures resulting in reduction of livestock use and output
- Passive restoration of native plant communities, which could require allotment resting for one to two seasons potentially reducing livestock use and output. In some cases fencing can be used to mitigate impacts.
- Delayed reintroduction of livestock following wildfires resulting in reduced livestock use and outputs over time

Table 8. Site type descriptions and acres

Site Type ID	Description	No. of Infested Sites	Total no. of infested acres if entire infested acreage is included	No. of infested Acres that meet criteria (portions of infested sites)
1	Within 50 ft. of existing, not decommissioned roads	2,252	1,868	1,178
2	Within 100 ft. of existing, not decommissioned roads	2,495	1,950	1,491
3	Within 50 ft. of all roads including decommissioned roads	2,301	1,904	1,244
4	Within 100 ft. of all roads including decommissioned roads	2,552	1,983	1,572
5	Within 25 ft. of trails	91	94	21

6	Within 25 ft. from all streams and ditches	589	1,199	117
7	Within 100 ft. from all streams and ditches	1,045	1,389	462
8	Within wildfire boundaries < 30 years old	409	451	246
9	BAER Inventory (outside wildfire boundaries)	93	38	39
10	Within timber harvest boundaries less than 30 years old	1,467	1,419	729
11	Within 100 ft. of a recreation site	7	20	< 1

Effectiveness of Treatment –

We assume that the average effective treatment on a given site would be about 80 percent effective, meaning that there would be 80 percent fewer invasive plants in the treated area the year following treatment. While commercial acceptability for herbicides is 90 to 95 percent control, we assume less effectiveness because these expectations are unlikely to be realized in a forested, rather than agricultural setting. The 80 percent effective estimate assumes a full range of tools are available for effective treatments. This can include manual or mechanical treatments along with herbicides, biological, and cultural treatments.

We also assume that, given the treatments proposed, weeds will spread at a rate of 4-12 percent over the life of the project. Prevention will slow but not stop spread. Some introductions and events are not controllable. Agricultural land managers and other neighbors (BLM, Park Service, County and State) are effectively managing weeds and preventing any *predictable* spread to National Forest. However, adjacent agricultural lands may be a persistent vector for invasive plant spread.

If the toolbox is restricted and some situations cannot be effectively treated, the percentage can be assumed to dramatically decrease. Limitations in the type or method of herbicide application would reduce effectiveness by one-third to one-half. On page 4-18, the R6 2005 FEIS notes that “since the effectiveness of herbicides varies with site characteristics, alternatives that have the widest variety of herbicides and herbicide families available for use have the greatest potential to result in effective treatments.” In contrast, when herbicide use is more restricted, “fewer acres would likely be achieved at a constant budget and the years to control increases proportionally” (ibid page 4-21). The variables in the action alternatives for this project that influence treatment effectiveness include:

1. Whether or not aminopyralid may be used as the first choice herbicide. This newer herbicide is the first choice for 64 percent of the primary target species found on Malheur National Forest. In alternative B, we could use this herbicide almost everywhere on the Malheur National Forest, including to the water’s edge. In alternative C, we could use this herbicide almost everywhere, except within 100 feet of stream or other water body. We would not use this herbicide in alternative D.
2. The herbicide application rates and methods approved influence our ability to effectively treat invasive plants. Alternative C does not approve any boom spraying and does not allow more than 70 percent of the maximum herbicide label rate to be sprayed on a given acre. This is estimated to double the time and cost of treating about 400 acres that would otherwise be broadcast sprayed.

Whether or not picloram may be used influences our ability to adapt to treatment results. The duration of its both positive and negative effects may be greater than our other herbicides due to its persistence in some soil types.

Further discussion of treatment effectiveness may be found in Chapter 2 of the EIS for this project. Appendix B of this report discusses relative effectiveness of different treatment methods.

Alternative A – No Action

Direct, indirect and Cumulative Effects

Direct effects occur at the same time and place as a Forest Service action. Indirect effects are effects associated with an action that occur at a place or time distant from the action. Cumulative effects are effects associated with an action that combine with other actions or natural ground disturbing events to create a larger, more intense, or different impact to a particular resource.

Since no action would occur, there are no direct, indirect, or cumulative effects associated with choosing the no action alternative. The no-action alternative provides a baseline for comparison of effects of action alternatives. If no action were selected for this project, no invasive plant treatments would be authorized. By definition, this would mean that our invasive plant treatment program would not be updated to follow current policies, and treatment tools would not be added to our invasive plant treatment toolbox. This section discusses the consequences of implementing alternative A.

Since 2002, when use of biological agents and chemicals for invasive plant control was enjoined by the court on the Malheur National Forest, most treatments have been manual (primarily hand pulling and digging) with limited mechanical treatment (primarily mowing). The one exception is the portion of the Ochoco National Forest administered by the Emigrant Ranger District, which was not included in the 2002 injunction. The Malheur National Forest has contracted with Harney County to treat about 20-40 acres per year on that land using herbicides. In 2011, the Malheur National Forest treated about 203 acres with manual and mechanical treatments using "Forest Service personnel, County cooperators, and Nature Conservancy volunteers" (R6 2011 accomplishment report). In 2010, the Malheur National Forest treated 375 acres in essentially the same manner (R6 2010 accomplishment report).

If alternative A is selected, we would likely continue to treat invasive plants using categorical exclusions (manual and limited mechanical treatments). We may also treat invasive plants when they are connected to a larger project (such as a vegetation or fuels management project). Invasive plant treatments would likely continue on state road right of ways and easements within the Malheur National Forest that are not subject to Forest Service control. Effects of those actions are not discussed here but would be considered during the planning for those projects.

Many current infestations would continue to spread, and new detections would likely remain untreated, especially if they are species not effectively treated by hand pulling or mowing. Prevention measures applied during land uses would slow (but not stop) the spread of invasive plants on the Forest and surrounding lands (see chapter 3.1of the EIS for more information about the potential for spread of invasive plants over time within the Forest) given the propagule pressure and type of expected disturbance associated with surrounding land uses and activities.

Alternative A addresses some public concerns by eliminating most herbicide use on the Forest. There would continue to be low or no risks or impacts from herbicides on human health, nontarget vegetation, pollinators, soils, water, aquatic organisms, or wildlife. However, the threats to the environment from invasive plants would continue unabated. Neighbors would continue to be frustrated in their attempts to enlist the Forest Service to help with partnerships to implement effective integrated treatments within and outside Forest boundaries.

No biological agents have been deliberately released on the Malheur National Forest, and we were enjoined from releasing these agents in the 2002 Court Order. However, biological agents that have been released in surrounding National Forests and other lands disperse to new areas on their own. The analyses of the environmental effects of biological control agents have already been completed under documents developed by Agricultural Plant Health and Insect Service (APHIS) for approval of their use. The completed environmental impact statements are available at: http://www.aphis.usda.gov/ppq/enviro_docs/index.html. These analyses assume the agent may occur throughout the range of its host invasive species.

Therefore, although they have not been released by the Malheur National Forest, biological control agents are helping to suppress or contain established populations of invasive plants here. Common biological agents released on neighboring Forests and adjacent counties and are likely already on the Forest are displayed in table 9.

Table 9. Biological agents released on neighboring lands

Target Species	Agent	Mode of Action
Bull Thistle	*Urophora stylata*	Larvae form a hard multi-chambered gall in the flower receptacle that interferes with seed production.
Canada Thistle	*Ceutorhunchus litura*	Larvae mine pith in stems of flowering plants, increasing susceptibility to pathogens. Adults feed on leaves.
Canada Thistle	*Urophora cardui*	Larvae cause galls on the stems that act as nutrient sinks, stressing plants and reducing seed production and growth.
Dalmation Toadflax	*Mecinus janthinus*	Larvae are stem miners; adults can cause damage to flowers and young leaves.
Diffuse Knapweed Spotted Knapweed Meadow Knapweed	*Urophora affinis* *Urophora quadrifasciata*	Larvae overwinter in the seed heads. Developing larvae cause the plant to form a gall around the reproductive parts and create a metabolic sink, drawing nutrients from the plant that extend beyond the attacked seed head.
Field Bindweed	*Aceria malherbae*	Adult and nymphal mites suck plant juices that deforms leaves and developing buds, which interferes with flowering, seed production, and reduces plant biomass.
Leafy Spurge	*Aphthona cyparissiae,* *Aphthona flava,* *Apthona nigriscutis* *Aphthona czwalinae,* *Apthona lacertosa*	Adults feed on foliage reducing the plant's production of sugars; larvae feed on root hairs and young roots reducing the plant's ability to take up water and nutrients.
Leafy Spurge	*Oberea erythrocephala*	Larvae bore in the stems and roots of larger plants. Adults girdle the top of the stalk before laying eggs in the stem.
Mediterranean Sage	*Phrydiuchus tau*	Adults feed on the leaves, and larvae feed in the root crown and petioles of large leaves.
Musk Thistle	*Rhinocyllus conicus*[1]	Larvae eat seeds in primary heads, lateral heads still produce seed.
Musk Thistle	*Trichosirocalus horridus*	Larvae feed on the root crown, damaging the primary shoot, and adults feed on the leaves. Large numbers of larvae can kill rosettes.
Musk Thistle	*Urophora solstitialis*	Larvae cause galls in the seed heads that interfere with seed production and dissemination.

Target Species	Agent	Mode of Action
Spotted Knapweed	*Cyphocleonus achates*	Larvae are root borers and adults feed on the leaves
Spotted Knapweed	*Metzneria paucipunctella*	Larvae consume seeds in infested heads.
Spotted Knapweed, Diffuse Knapweed	*Bangasternus fausti*	Attacks the project EISrly buds, and appears to contribute to the impacts of *Larinus minutus*. Larvae consume most of the seeds in infested heads.
Spotted Knapweed, Diffuse Knapweed	*Larinus minutus*	Larvae feed in the flower head destroying most of the seeds. Heavy attack by adults can stunt or kill plants and delay flowering.
Spotted Knapweed Meadow Knapweed Diffuse Knapweed	*Larinus obtusus*	Larvae consume the seeds and adults can defoliate plants when in large numbers.
St Johnswort	*Chrysolina quadrigemina* *Chrysolina hyperici*	Adults and larvae are foliage feeders.
Tansey Ragwort	*Longitarsus jacobaeae*	The larvae feed on the roots of the target plant.
Yellow Starthistle	*Bangasternus orientalis*	Larvae feed on seeds and seed heads, reducing the number of seeds by 40-60%
Yellow Starthistle	*Chaetorellia australis*	Larvae tunnel into the center of the head, where they feed on the ovaries and developing seeds.
Yellow Starthistle	*Chaetorellia succinia*[1]	Larvae tunnel into the center of the head, where they feed on the ovaries and developing seeds.
Yellow Starthistle	*Eustenophus villosus*	Adults feed on developing buds, causing the buds to die. Larvae feed on the seed head and developing seeds.
Yellow Starthistle	*Larinus curtus*	Adults feed on the flowers and larvae feed on the seed head, reducing seed production.
Yellow Starthistle	*Urophora sirunaseva*	Larvae feed on flowers and seed heads and cause formation of galls.

Healthy plant communities are often fairly resistant to most of the current invasive species that are present on Forest range allotments. There are many factors that affect the susceptibility of native plant communities to invasive plant infestations; however, it is generally recognized that lower elevation, more open (and often more arid) or disturbed ecosystems tend to be more fragile and less resilient to invasion compared to higher elevation, more closed (and often more moist) and less disturbed environments. Drier climates, such as that of the Middle Rocky Mountain Ecoregion and the eastern portion of the Cascade Sierra Steppe ecoregions, are generally at greater risk to invasives than more mesic western portions of the Cascade Ecoregion (Fiedler et al. 2010, R6 FEIS 2005). And in Oregon, xeric grasslands comprised mostly of perennial bunchgrass communities, upland shrub communities, and riparian areas are susceptible to the most non-native plant species, while subalpine meadows and moist spruce forests are susceptible to the fewest invasive plant species (R6 FEIS. 2005, Hansen and Clevenger 2005).

Invasive plants are currently damaging the ecological integrity of lands within and outside Malheur National Forest range allotments. Despite current treatment, invasive plants continue to increase and occupy previously uninfested areas. Invasive plants spread annually (R6 FEIS 2005) within National Forest system lands and neighboring areas, affecting all land ownerships. As current conditions change, and as invasive species continue to spread via common dispersal methods, management activities such as livestock grazing may be affected

Implementing alternative A would indirectly affect native plant communities. The high colonization potential of invasive plants can change the trajectory of growth away from desired plant communities. Most of the Malheur National Forest invasives cover large areas quickly and reduce the diversity of desired grasses and forbs. Loss of native plant communities may continue to occur as invasive weeds occupy and out-compete native species. Once invasive species begin to dominate these communities, a loss of species diversity, composition, and ecosystem function could occur. Invasive species would likely continue to spread into areas that are not currently infested. As weeds become established, these areas would likely serve as weed seed sources for other areas of the Forest and nearby ownerships. Alterations to native plant communities and increases in weedy species would reduce forage for livestock.

Certain invasive plants are known to be toxic to various classes of permitted livestock. Canada thistle has the potential to concentrate nitrates and cause nitrate poisoning in ruminants. Russian knapweed and yellow starthistle both produce a unique poisoning of horses that is generally fatal. Leafy spurge can cause excessive salivation and diarrhea in cattle; however it does not appear to affect sheep and goats (USDA Forest Service 2012c). Houndstongue and tansy are toxic and cause liver problems in livestock, particularly horses and cattle.

Alternative A eliminates the risk of treating non-target plants with herbicide for the Malheur NF administrative boundary. The Ochoco National Forest lands, administered by the Emigrant Creek Ranger District, that allow herbicide under a prior decision, pose some risk to treating non-target plants.

Issue indicators

1. *Type and extent of herbicide use that could result in harmful exposure scenarios to livestock*

   Herbicides would not be used.

2. *Amount of time and area where livestock may need to be restricted during and after herbicide use*

   There would be no restrictions on livestock use for the first choice herbicides.

3. *Qualitative assessment of the effectiveness of buffers and other project design features to prevent harmful herbicide exposure scenarios*

   There would be no need for buffers or project design features.

4. *Assessment of treatment costs and effectivess*

   Treatments would be restricted to some roadside treatments and the levels of biocontrol that currently exist or develop over time without new distributions. Since many invasive infestations occur along roads, mechanical treatments (mowing), if timed to occur before seed set, could effectively control many infestations. Mechanical treatment would not be likely to eliminate infestations or reduce their size. Manual and mechanical methods on the Umatilla were calculated to be approximately 20 percent effective (Laufman 2007). Biocontrols of Dalmatian and yellow toadflax appear to be effective at this time. If insects remain in place, biocontrols would continue to be effective.

Consequences of No Action

This alternative would not meet the desired future condition which is: "to retain healthy native plant communities that are diverse and resilient, and restore ecosystems that are being damaged, and to provide high quality habitat for native organisms throughout the forest, and assure that invasive plants do not jeopardize the ability of the forest to provide goods and services communities expect." Invasive species would continue to spread as documented from past inventories.

Alternative B – Proposed Action

Alternative B responds to the purpose and need for action by authorizing several herbicide and other integrated treatment methods to be implemented on the Forest over the next 5 to 15 years. These options are intended to effectively reduce the size and density of invasive sites and abate the adverse effects of invasive plants. The project would continue to be implemented each year until the treatments are no longer needed or conditions substantially change on the ground to such a degree that the analysis in the EIS is no longer valid. The annual implementation planning process described in Chapter 2 of the project EIS discusses how changed conditions would be evaluated for this project over time.

Alternative B responds to public concerns about treatment effectiveness by authorizing a wide range of integrated treatment methods that would be prioritized, planned and implemented in cooperation with our neighbors (Table 10). We would start to use herbicides and redistribute biological control agents on the Malheur National Forest as soon as practicable after the NEPA decision.

Early Detection Rapid Response

Early Detection Rapid Response (EDRR) is part of all the action alternatives. Under this approach new or currently unknown infestations may be treated using the range of methods proposed in the EIS on sites similar to those presently proposed for treatment. Project design features would constrain treatment methods according to site specific conditions to minimize impacts. Higher risk aerial application would not be used.

Table 10. Treatment methods authorized under alternative B

Treatment Method	Description
Manual	Includes hand pulling or using hand tools (e.g., grubbing), to remove plants or cut off seed heads. Manual treatments are labor intensive, effective only for relatively small accessible areas, and would be repeated several times throughout the growing season depending on the species. Handsaws, axes, shovel, rakes, machetes, grubbing hoes, mattocks, brush hooks, and hand clippers may all be used to manually remove invasive plant species. Other manual methods could include mulching, hot water steaming, foaming, or solarization techniques such as using black plastic to cover invasive plants to shade out and kill pieces of roots (i.e. rhizomes). These techniques could be used where minimizing herbicide use is desirable such as areas with an abundance of sensitive wildlife or plant species.
Mechanical	Mechanical methods use power tools and include such actions as mowing, weed whipping, road brushing, and root tilling. These activities would typically occur along roadsides, rock sources, or other confined disturbed areas and dispersed use areas. Mowing and cutting would be used to reduce or remove above ground biomass. Seed heads and cut fragments of species capable of re-sprouting from stem or root segments would be collected and properly disposed of to prevent them from spreading into non-infested areas.

Treatment Method	Description
Biological Agents	Biological agents are parasitic insects, mites, nematodes, and pathogens that feed on specific parts of invasive plants and inhibit their growth and spread. In some situations, a suite of biological control agents is needed to reduce weed density to a desirable level. For instance, a mixture of five or more biological control agents may be needed to attack flower or seed heads, foliage, stems, crowns and roots all at the same time or during the plant's life cycle. Typically 15 to 20 years are needed to suppress or contain an established population of invasive plants. Agents approved by the Animal and Plant Health Inspection Service (APHIS) that are proven natural control agents of specific invasive species but do not harm other species may be released.
Cultural Methods/ Restoration	Cultural controls are defined in the R6 2005 FEIS as: "The establishment or maintenance of competitive vegetation, use of fertilizing, mulching, prescribed burning, or grazing animals to control or eliminate invasive plants" (page 10). In this project, the following cultural treatments are not included: burning, tilling, plowing and mechanical seed drilling. Mulching, seeding, planting would be used to encourage native plant survival and re-establishment, speed reoccupation of a site by native vegetation, and provide erosion protection.
Herbicides	Herbicides would be used to contain, control and eradicate invasive plants that are not cost-effectively treated by other methods. When herbicide use is proposed to occur in or near sensitive areas, specific design features would be used to insure that vegetation treatments do not have an adverse impact on non- target plants or animals. Herbicide treatments, chemical mixing, spill prevention, and clean up would be done in accordance with Forest Service policies, plans and product label requirements.
Herbicide Application Method: Selective spraying	Targets individual plants. Herbicide is usually applied by hand.
Herbicide Application Method: Spot Spraying	Targets individual to small clumps of plants. Herbicide is usually applied with a backpack sprayer or other hand pump system. Spot spraying is also done using a hose off a truck-mounted or ATV-mounted tank. Most of the current infestations could be effectively treated by a spot spray.
Herbicide Application Method Broadcast Spraying	Herbicide is applied to a continuous population of invasive plants. This method is used when the weed is dense enough that it is difficult to discern individual plants and the area to be treated makes spot spraying impractical. Larger and denser infestations may require a broadcast spray. In cases where the invasive plant covers more than 70 percent of an area that is bigger than 0.1 acre, broadcasting may be the most cost-efficient method. Less than 20 percent of the infested acreage (about 400 acres) is estimated to require a broadcast spray based on the continuity and density of the current infestations.

We would use aminopyralid for the first year or so of treatment because it is the first choice herbicide for about 1,350 acres (64 percent of the total infested acreage) and because it is considered the most effective of the eleven available herbicides for 13 of the 18 primary target species (all except houndstongue, toadflax, pepperweed and whitetop, which have chlorsulfuron as the first choice herbicide; and sulphur cinquefoil, that has met metsulfuron methyl as the first choice herbicide). We would use the other effective herbicides as needed over time, depending on the effectiveness of the first choice. Other herbicides that could be used in later years if the first choice herbicides are not effective are listed in Chapter 2, Table 5 of the project EIS (common control measures) and in table 11 below.

The lowest effective herbicide concentration would be applied. Maximum application rates may be used if necessary in small areas (table 11), but in general, spot and broadcast treatments would use typical or lower application rates.

Under alternative B, biological control agents would be deliberately redistributed to suppress or contain established populations of invasive plants on the Malheur National Forest. Redistribution or release of biological control agents would be done as part of the Oregon Department of Agriculture Biological Control Program and meet the requirements of R6 ROD Standard 14. The treated areas would continue to be inventoried and monitored to determine the success of the treatments and when the released biological control agents have reached equilibrium with the target species. This EIS is tiered to the R6 2005 FEIS and various and ongoing APHIS NEPA documents for the release of biological control agents. By definition, only agents that have been approved by APHIS would meet the R6 2005 ROD Standard 14. See table 9. under the alternative A discussion for the list of approved biological agents for target species that are currently found on the Malheur National Forest.

Treatment caps would be applied to provide further sideboards to minimize adverse effects and ensure that the effects of treatments authorized under this EIS are consistent with the analysis disclosed in this EIS. Under alternative B:

- In no case would more than 2,124 discrete acres be treated using herbicides in a single year (based on our existing, site-specific inventory).
- No more than 30,000 acres (including initial and repeat treatments) would be treated using any method over the life of the project.
- No more than 10 percent of the total acres of any 6th field subwatershed, and no more than 10 acres within 100 feet of any water body in a 6th field watershed would be treated with herbicide in a single year.[2]

Table 11. Herbicide descriptions

Active Ingredient	Typical Application Rate (lb per ac)	Highest Application Rate (lb per ac)	Remarks
Aminopyralid	0.078	0.11	This herbicide poses a very low risk to the aquatic environments. We will avoid ground water contamination as per label instructions. Aquatic formulations are not available but we can use this herbicide up to the water's edge in most situations. It is the first choice herbicide for about 64% of the currently infested acreage (about 1,346 acres).
Chlorsulfuron	0.056	0.25	This herbicide poses a moderate risk to the aquatic environments and there are no aquatic formulations. We will not use this herbicide next to streams or on certain soils or near certain non-target plants as per project design features. It is the first choice herbicide for about 28% of the currently infested acreage (about 591 acres).
Clopyralid	0.35	0.5	This herbicide poses a low risk to aquatic environments. We will implement some soil restrictions due to its increased mobility in some soil types and we will avoid ground water contamination as per label instructions.

[2] Currently, a total of 470 acres of invasives lie within 100 feet of a water body. This acreage is scattered mainly along roads within 6th field sub-watersheds. If infestations that continue beyond the 100 foot boundary are measured in their entirety, there are 1,389 acres that would be treated as being within the 100 foot boundary.

Active Ingredient	Typical Application Rate (lb per ac)	Highest Application Rate (lb per ac)	Remarks
Glyphosate	2	7	This is one of the most common herbicides used in Oregon and has the advantage of being effective on a very wide range of target species. Aquatic formulations are available; however glyphosate has ingredients that may pose higher risk to aquatic environments. It is non-selective and quickly taken up by target plants. Many people have expressed concern about “round up” or “round up ready GMO crops” and its effect on human health. However, the studies that underpin the concerns are not applicable to the proposed project. The glyphosate risk assessment was updated recently and all current science was considered.
Imazapic	0.13	0.19	This herbicide poses a moderate risk to aquatic environments and there is no aquatic formulation. This herbicide is associated with a concern for non-target plants and we will protect botanical species of conservation concern.
Imazapyr	0.45	1.25	This herbicide poses a low risk to aquatic environments and an aquatic formulation is available. This herbicide is also associated with a concern for non-target plants and we will buffer botanical species of conservation concern.
Metsulfuron Methyl	0.03	0.15	This herbicide poses a moderate risk to aquatic environments and no aquatic formulations are available. We will buffer streams when using this herbicide. This herbicide is also associated with a concern for non-target plants and we will protect botanical species of conservation concern. It is the first choice herbicide for about 8% of the currently infested acreage (about 186 acres).
Picloram	0.35	1.0	This herbicide poses higher risk to aquatic environments and there is no aquatic label. We will not use this herbicide near streams, especially because it is toxic to certain aquatic species and it can be very mobile. It is valued (and respected) for its persistence in the soil; we will not use it on certain soils and we will use it infrequently to protect soil biology.
Sethoxydim	0.3	0.38	This herbicide poses a moderate risk to aquatic environments and there is no aquatic label. We will not use it near streams. It is very selective (only kills grasses).
Sulfometuron Methyl	0.045	0.38	This herbicide poses a moderate risk to aquatic environments and no aquatic formulations are available. We will buffer streams when using this herbicide. This herbicide is also associated with a concern for non-target plants and we will protect botanical species of conservation concern.
Triclopyr	1.0	10	This herbicide poses higher risk to aquatic

Active Ingredient	Typical Application Rate (lb per ac)	Highest Application Rate (lb per ac)	Remarks
			environments, however there is an aquatic label that reduces (but does not eliminate) the risk. We will not use this herbicide near streams. This herbicide poses some risk to herbicide applicators and will not be broadcast as per R6 2005 ROD Standard 16. It may only be spot or selectively applied and only in limited cases.

Direct and Indirect Effects

Long-term effects of invasive weed treatments on grazing allotments would be the retention of currently available forage, reduction in spread from existing and unknown future infested sites, and recovery of native vegetation in areas currently impacted by invasives. There may be some short-term direct effects to existing grazing administration and allotments if alternative B is implemented, including management such as timing and duration of grazing, patterns of use, requirements to use only weed free feed, and the potential for quarantine periods. However, range managers would be alerted before invasive plant treatments and could arrange grazing schedules accordingly. Livestock exposure to toxic weed species would be reduced.

Herbicide Use

Under the Proposed Action more chemicals would be used in the environment while effectively treating invasive species compared to the no action alternative. The potential for a spill to occur during herbicide operations would be greater than under the no action alternative based on the number of acres that would be treated. Minimal to no effects are anticipated to grazers or operators due to strict adherence to label handling directions and spill containment protocols in the unlikely event of a spill.

First Choice Herbicides

First choice herbicides have been identified for each invasive plant species for each alternative. For alternative B, first choice herbicides are aminopyralid, chlorsulfuron, and metsulfuron methyl.

Exposure routes for herbicides in terrestrial animals include direct spray, the ingestion of contaminated media (vegetation, prey species, or water), grooming activities, or indirect contact with contaminated vegetation.

None of the first choice herbicides have label restrictions for use with livestock. The available risk assessment literature for the first choice herbicides has not found adverse effects to mammals. Aminopyralid has label restrictions for the use of grasses or hay treated within 18 months for several uses other than direct forage for livestock (Table 12).

Table 12. Estimated acres of first choice herbicide use and potential effects

First choice herbicide	Estimated acres of spray Broadcast / spot	Potential effect
Aminopyralid	1180/168	Non-target forage plants may be killed by direct spray or spray drift. There is no indication that tolerant species of terrestrials plants (such a grasses), aquatic plants (algae or macrophytes), mammals, birds, aquatic or terrestrial invertebrates, terrestrial microorganisms, fish, and amphibians will by adversely affected by aminopyralid (SERA 2007).
Chlorsulfuron	71/519	Non-target forage plants could be killed by drift or runoff. Off-site runoff of chlorsulfuron could be substantial in conditions that favor runoff. The available data are sufficient to assert that no adverse effects are anticipated in terrestrial animals that do not directly depend on the weeds that are targeted (SERA 2004).
Metsulfuron methyl	30/156	Non-target forage plants could be killed by drift or runoff. Off-site runoff of metsulfuron methyl could be substantial in conditions that favor runoff. The available data are sufficient to assert that no adverse effects are anticipated in terrestrial animals that do not directly depend on the weeds that are targeted (SERA 2005).

Other herbicides

Other herbicides could be used in later years if the first choice herbicides are not effective (table 13 and table 5 in the project EIS). Some of these herbicides have label use restrictions that would be followed with reference to livestock grazing and/or slaughtering (table 13) after herbicide treatment. Moving livestock or treating pastures that are currently in rest due to grazing management rotations would eliminate any potential effects. All label use restrictions would be followed in addition to PDFs that require permittee notification prior to any proposed application. In addition, timely notification and coordination should occur during annual operating plan meetings and by posting or signing areas to be treated prior to and after treatment (R6 FEIS 2005).

Herbicides that may directly affect grazing animals (clopyralid, triclopyr and picloram) have label restrictions on grazing after herbicide treatment (Table 13). These herbicides would have more potential for adverse effects to livestock than the first choice herbicides, but use of label restrictions would prevent potential effects. Below is information about effects of each non-first choice herbicide listed for potential use in the common control measures table of the project EIS. The information is derived from SERA risk assessments. In the risk assessment methodology, hazards to target organisms are measured as a hazard quotient (HQ). A hazard quotient of 1 or greater is considered to be of concern.

Clopyralid (SERA 2004b) appears to be relatively non-toxic to terrestrial or aquatic animals; it is highly selective in its toxicity to terrestrial plants, and relatively non-toxic to aquatic plants. Thus, the potential for substantial effects on non-target species appears to be remote. However, some decreased body weight has occurred in rats at lowest dose levels. Effects on liver and kidney weight as well as changes in gastric epithelial tissue have also been noted at dose levels similar to those associated with changes in body weight.

Glyphosate (SERA 2011b). There are numerous formulations of glyphosate. In the risk assessment, distinctions are made between more and less toxic formulations. At the unit application rate of 1 lb a.e./acre, none of the hazard quotients for mammals exceed the level of concern (HQ=1). At application rates of 2.5 lb a.e./acre or less, worst-case exposure assessments indicate that mammals are not at risk. This risk characterization is supported by well-documented field studies that failed to identify adverse effects in populations of small mammals following applications of Roundup as well as another unidentified formulation of glyphosate.

Less toxic formulations of glyphosate pose no apparent risks to mammals. At the unit application rate of 1 lb a.e./acre, the highest HQ for any mammalian receptor is 0.005, which is associated with the consumption of contaminated water following an accidental spill. At the maximum aquatic application rate of 3.75 lb a.e./acre, the HQ for the accidental spill would be about 0.02 [(0.005/1 lb a.e. per acre) x 3.75 lb a.e./acre = 0.01875], which is well below the level of concern.

Imazapic (SERA 2004d). The weight of evidence suggests that no adverse effects in mammals or birds are plausible using typical or worst-case exposure assumptions at the typical application rate of 0.1 lb/acre or the maximum application rate of 0.1875 lb/acre. The available data are sufficient to assert that no adverse effects are anticipated in terrestrial mammals or birds.

Imazapyr (SERA 2011c). For aquatic applications, none of the HQs approaches a level of concern. The highest HQ of 0.009 is associated with the upper bound of the HQ for a canid consuming contaminated fish following an accidental spill. This HQ is below the level of concern (HQ=1) by a factor of over 100. None of the hazard quotients for terrestrial applications exceed the level of concern. The highest HQs are associated with consumption of contaminated grass by a small mammal—i.e., HQs of 0.2 (0.02 to 0.9). All exposure scenarios for all larger mammals are no greater than 0.2, below the level of concern by a factor of 5.

Picloram (SERA 2011d). There are no clear organ-specific pathological effects are associated with picloram, and the most sensitive endpoints appear to be nonspecific alterations in the staining properties of liver tissue with altered liver and kidney weights noted at higher doses.

Sethoxydin (SERA 2001). None of the hazard quotients reached a level of concern in risk assessments, even at the highest exposures. The hazard quotients are below a level of concern by a factor of at least 10 for acute exposure scenarios for a large mammal consuming vegetation. The evidence suggests that no adverse effects in terrestrial animals are plausible using typical or even very conservative worst case exposure assumptions.

Sulfometuron methyl (SERA 2004). The highest hazard quotient for any acute exposure is 0.04 for the consumption of contaminated insects by a small mammal. For chronic exposures, all hazard quotients are well below one. The highest hazard quotient is 0.2 for chronic consumption of vegetation by a large mammal feeding exclusively on vegetation treated at an application rate of 0.38 lb a.e./acre. There is no basis for asserting that adverse effects are likely from the application of sulfometuron methyl at any application rate, even the maximum application rate of 4-30 0.38 lb a.e./acre, that might be used in Forest Service programs.

Triclopyr (SERA 2011). The only exposure scenario of concern is the ingestion of contaminated vegetation. The HQs for mammals increase as body weight increases. While small mammals may consume more than larger animals, the higher sensitivity of larger mammals to triclopyr suggest they are at greater risk. At the unit application rate of 1 lb a.e./acre, the acute HQs for a large (70 kg) mammal consuming contaminated short grass are 2 (0.2 to 11). The corresponding chronic HQs are 5 (0.2 to 53).

Based on relatively standard methods used to estimate risks to mammals from well-conducted toxicity studies as well as reasonably well- documented estimates of exposure, it is likely when using triclopyr that mammals would be exposed to doses that exceed the level of concern. In extreme cases, adverse effects could be anticipated in some mammals, particularly larger mammals, at application rates as low as 1 lb a.e./acre. These effects might not involve overt signs of toxicity that would be observed in field studies.

Chronic HQs for mammals are substantially higher than the acute HQs. This suggests that while overt signs of toxicity might not be evident shortly after triclopyr applications, longer-term adverse effects on mammalian populations, possibly involving changes in reproductive rates, could occur. While these effects are not reported or otherwise noted in field studies, available field studies focus on small mammals, and the available literature does not include longer-term studies on populations of larger mammals (carnivores or herbivores).

Exposure scenarios not involving the consumption of contaminated vegetation—i.e., direct spray and the consumption of contaminated water and fish—lead to HQs for triclopyr that are far below the level of concern. The only residual concern with mammals following aquatic applications of triclopyr involves the treatment of emergent vegetation. Methods to estimate doses from this type of exposure are not available. By analogy to the consumption of terrestrial vegetation by mammals, mammals consuming treated emergent aquatic vegetation could be exposed to triclopyr at levels which might exceed the level of concern.

Adjuvants/Surfactants (Bakke 2002, 2003)*:* Surfactants are one type of adjuvant that makes herbicides more effective by increasing absorption into the plant. Many of the inert ingredients are proprietary in nature and have not been tested on laboratory species. However, confidential business information (i.e. the identity of proprietary ingredients) was used in the preparation of the herbicide risk assessments. Surfactants are discussed in Chapter 2 of the project EIS and limitations for their use are listed in the pdfs.

Table 13. Label restrictions by herbicide

Herbicide	Brand Name	Restriction	Remarks
Aminopyralid	Milestone Milestone VM	Grasses treated in the preceding 18 months CAN NOT be moved off the farm or ranch where harvested unless allowed by supplemental labeling. Hay treated in the preceding 18 months CAN NOT be used for silage, hayfage, baylage and green chop unless allowed by supplemental labeling.	May be used up to the edge off water.

		Do not use hay or straw from areas treated within the preceding 18 months or manure from animals feeding on treated hay in compost. Do not use grasses treated within the preceding 18 months for seed production.	
Chlorsulfuron	Telar, Glean, Corsair, Landmark (oust + telar)	None	
Clopyralid	Transline, Redeem (Clopyralid + Triclopyr)	Redeem: Do not graze treated areas until poisonous plants are dry and no longer palatable to livestock. Withdraw livestock from grazing treated grass at least 3 days prior to slaughter.	See label for cropland grazing restrictions post treatment in pastures. Redeem: Herbicide application may increase palatability of poisonous plants.
Glyphosate	RoundUp, Rodeo, etc.	None	RoundUp: ingestion of this product or large amounts of freshly sprayed vegetation may cause temporary gastrointestinal irritation.
Imazapic	Plateau	Plateau: None. Plateau DG: Do not use on areas to be grazed.	
Imazapyr	Arsenal, Chopper, Stalker	Arsenal: none. Chopper: none. Stalker: none.	
Metsulfuron methyl	(Escort)/Sulfonylurea	None.	
Picloram	Tordon	Tordon 101/22K/K: allow one week of grazing/feeding in non-exposure area before moving livestock onto broadleaf cropland. Tordon 22K: herbicide application may increase palatability of poisonous plants. Don't graze treated areas until poisonous plants are dry and no longer palatable. Meat grazing animals should be removed from treated areas 2 weeks after treatment and 3 days prior to slaughter.	
Sethoxydim	Poast	None for grazing or range management.	
Sulfometuron methyl	Oust	None for grazing or range management.	
Triclopyr	Garlon	Garlon 4: Do Not allow lactating dairy animals to graze treated areas until the following growing season after treatment. Do not harvest hay for 14 days after treatment.	

		Withdraw livestock from grazing treated areas at least 3 days before slaughter.	

Other treatment methods

Manual treatments would be used in small areas and would not likely affect livestock except to remove the invasive plants including potentially toxic species and potentially increase the amount of forage. Mechanical treatment would most likely involve mowing along roadsides. Mechanical treatments would not likely affect livestock use. It would temporarily remove invasive plants, but would not eliminate them. Biological controls would reduce amounts of invasive plants and allow for native species to expand. Cultural controls would be used in very small areas and should not affect livestock.

Early Detection and Rapid Response

In addition, new or previously undiscovered infestations could be treated using the range of methods described in this EIS. An early detection and rapid response (EDRR) approach is needed because (1) the precise location of individual target plants, including those mapped in the current inventory, are subject to rapid and/or unpredictable change, and (2) the typical NEPA process does not allow for rapid response to new detections; infestations may grow and spread into new areas during the time it usually takes to prepare NEPA documentation. The intent of the project early detection and rapid response approach is to treat new infestations when they are small so that the likelihood of successful treatment is maximized and adverse effects are minimized.

The action alternatives would allow treatment of new detections (EDRR), as long as the treatment method is within the scope of this EIS. The treatment of newly found sites adds additional risk factors to livestock just by adding additional exposure areas. This also expands the treatment into areas that may not have been originally anticipated. However, the implementation planning process identified in Chapter 2 would be used with each new infestation site to determine treatment. The pdfs have been set up to provide layers of caution so that even if the exact locations are not known, the potential for adverse effects are minimized. Implementation of pdfs and herbicide-use buffers and treatment limits would work together to provide sideboards to deal with the uncertainty of treating new sites (USDA Forest Service 2008b).

Issue indicators

1. *Type (rate, method, chemical properties) and extent of herbicide use that could result in harmful exposure scenarios to livestock*

   First choice herbicides used for alternative B are expected to have no adverse effects to livestock.

   In later years if other herbicides are used, some, because of their chemical properties (picloram, imazapic, clopyralid, triclopyr), have the potential for effects to livestock (table 13), however. impacts would not occur due to project design features and label restrictions.

2. *Amount of time and area where livestock may need to be restricted during and after herbicide use*

   There are no restrictions on livestock use for the first choice herbicides. There are restrictions on transporting grass, hay and straw sprayed with aminopyralid, but none for livestock grazing or feeding. There are grazing restrictions with use of clopyralid, imazapic, picloram and triclopyr (table 13).

3. *Qualitative assessment of the effectiveness of buffers and other project design features to prevent harmful herbicide exposure scenarios*

Following label restrictions and project design features would prevent harmful herbicide exposure scenarios for herbicides. Permittees would be notified of herbicide application and herbicide applicators would be required to follow herbicide label restrictions. Aquatic labeled herbicides would be used near water sources.

4. *Assessment of treatment costs and effectiveness*

This alternative increases the number and kinds of tools for controlling invasive plants. It is expected that proposed treatments would be approximately 80 percent effective, so invasive infestations would be reduced over approximately 3 years to a maintenance level (23 acres). Treatment costs would be $544 per acre. Herbicide use would be reduced over time as infestations are eliminated or reduced in size. Native vegetation and forage would recover as invasive plant occurrences decrease and restoration efforts begin.

Summary

Under this alternative treatment of invasive plants, including eradication at some locations, would allow forage to gradually recover and would meet the desired future conditions for the Malheur National Forest. Early detection and response for any newly established invasive species would occur. Impacts, especially long-term impacts, to grazing administration would potentially be reduced, because native and desirable non-native vegetation would increase. The treatment of existing and future documented infested sites under this alternative would positively affect range resources. Short-term effects to range management, such as timing and duration of grazing, patterns of use, requirements to use only weed free feed, and the potential of quarantine periods, should be prevented by project design features that require advance notice to range managers so they can organize management with minimal disruption

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Alternative B complies with national direction and with the R6 ROD (2005) for invasive plants. A Forest Plan amendment would be needed to allow the use of aminopyralid.

Alternative C – Strict Limitations on Herbicide Use

This alternative does not allow broadcast herbicide treatments within riparian areas, thereby reducing potential detrimental effects to aquatic and riparian ecosystems (reduced application of herbicides.and less potential for drift. For a full description of this alternative see Chapter 2 of the EIS.

Alternative C would address public issues about herbicide impacts to human health, non-target vegetation and pollinators, soils, water, aquatic organisms, and wildlife, while still allowing for some limited herbicide use. Under alternative C, all of the alternative components for alternative B would be followed, with the following additions and changes:

- No broadcasting of herbicide would be allowed. No boom spraying would be allowed. Maximum herbicide application rates per acre would be reduced by about 30 percent across the board. PDFs related to broadcast spraying would become non-applicable.

- No herbicide use would be allowed within the boundaries of any mapped infested area that at any point is within 100 feet of creeks, lakes, ponds and wetlands or 200 feet of well source areas. Non-herbicide methods would continue to be used within of these areas. The buffer tables associated with alternative B would become non-applicable since no herbicide use would be allowed within 100 feet of streams.

- Picloram would be eliminated from the list of available herbicides, due to its persistence, mobility and toxicity.
- Selective and spot treatment of herbicide would be limited to no more than 735 acres per year, or total 11,025 acres over the life of the project.
- No herbicide would be used on 1,389 acres. (This assumes that no herbicide would be used within the entire infested area if any part of the area is within 100 feet of a stream or water body or 200 feet of a well source area.)
- We would not treat more than 30,000 acres with any method through the life of the project.

These restrictions would apply to known sites as they change over time, as well as to new detections. The implementation planning process would be similar to alternative B, however the range of treatments that would be allowed would be more restrictive.

Direct and Indirect Effects

This alternative would result in fewer acres of herbicide use and would allow only spot herbicide use throughout the project area, and no herbicide use within 100 feet of streams and within 200 feet of wells. Picloram would not be used. Impacts to livestock operators would be similar to those described in alternative B. The potential for exposure of livestock and livestock managers would be slightly decreased as less chemical would be used within riparian areas.

Manual and mechanical treatments would increase. Approximately1, 389 acres would need to be treated with mechanical or manual methods rather than herbicide application For the most part, manual and mechanical treatments would not affect livestock

First choice herbicides would be the same as for alternative B.

Table 14. Estimated acres of first choice herbicide use and potential effects

First choice herbicide	Estimated acres of spray Broadcast / spot	Potential effect
Aminopyralid	0 / 560	Non-target forage plants may be killed by direct spray or spray drift. There is no indication that tolerant species of terrestrial plants (such a grasses), aquatic plants (algae or macrophytes), mammals, birds, aquatic or terrestrial invertebrates, terrestrial microorganisms, fish, and amphibians will be adversely affected by aminopyralid (SERA 2007).
Chlorsulfuron	0 / 142	Non-target forage plants could be killed by drift or runoff. Off-site runoff of chlorsulfuron could be substantial in conditions that favor runoff. The available data are sufficient to assert that no adverse effects are anticipated in terrestrial animals that do not directly depend on the weeds that are targeted (SERA 2004).
Metsulfuron methyl	0 / 33	Non-target forage plants could be killed by drift or runoff.

		Off-site runoff of metsulfuron methyl could be substantial in conditions that favor runoff. The available data are sufficient to assert that no adverse effects are anticipated in terrestrial animals that do not directly depend on the weeds that are targeted (SERA 2005).

Issue indicators

1. *Type (rate, method, chemical properties) and extent of herbicide use that could result in harmful exposure scenarios to livestock*

   First choice herbicides used for alternative C are expected to have no adverse effects to livestock.

   In later years if other herbicides are used, some, because of their chemical properties (imazapic, clopyralid, triclopyr), have the potential for effects to livestock. Impacts would be prevented by the use of project design features and label restrictions (table 13).

2. *Amount of time and area where livestock may need to be restricted during and after herbicide use*

   There are no restrictions on livestock use for the first choice herbicides.

   If other herbicides are used in later years, some may have restrictions, particularly clopyralid, imazapic, and triclopyr (table 13).

3. *Qualitative assessment of the effectiveness of buffers and other project design features to prevent harmful herbicide exposure scenario*

   Project design features are adequate to prevent harmful herbicide exposure to livestock. Permittees would be notified of herbicide application and would be required to abide by herbicide label restrictions. Under alternative C, buffers would restrict herbicide use on more acres and would restrict broadcast spraying, but would result in more mechanical or manual treatment in riparian areas.

4. *Assessmemt of treatment cost and effectiveness*

   The loss of the ability to use herbicides and broadcast spray in this alternative is estimated to reduce the effectiveness of treating all existing infestations to half of Alternative B (EIS 3.1.4). In addition, the potential effectiveness would be reduced due to the lack of picloram in the toolbox. The loss of the use of picloram would reduce our ability to effectively adapt to areas that do not effectively respond to aminopyralid or another first year first choice herbicide.

   Given that manual treatments are labor intensive and costly, it is unlikely that all the 1,389 acres within riparian buffers would be treated. Even if all acres were treated, treatment effectiveness would still be low due to the difficulty of removing roots and rhizomes for many invasive species.

   The most ambitious treatment scenario would treat all 2,124 acres within a year of this decision being signed (2014-2015 or Year 1). The following year, half of this acreage would still need to be treated and would be subject to annual spread. Under this scenario it would take 5 years of treatment to reduce invasive plants to a maintenance level (59 acres). Costs per acre for alternative C would be $722. Herbicide use would be reduced over a longer time period than under alternatives B and D. Native vegetation and forage would recover more slowly than under alternatives B and D.

Alternative D – No Forest Plan Amendment, No Aminopyralid

We developed alternative D to evaluate the tradeoffs involved with adding aminopyralid to the list of available herbicides in standard 16. Some members of the public have expressed doubt about whether or not this herbicide should be approved, mainly because it is new and effectively kills broadleaf plants.

Alternative D would be similar to alternative B, except a Forest Plan amendment would not be completed and aminopyralid would not be approved for use on the Malheur National Forest. Aminopyralid would not be used to treat known sites or new detections. The process for prescribing new detections and adapting to changes in existing mapped polygons would otherwise be similar to alternative B. More chlorsulfuron, glyphosate, metsulfuron methyl, and picloram, would be used in lieu of aminopyralid. The herbicide use rates, PDFs and herbicide use buffers associated with aminopyralid would become non-applicable.

Direct and Indirect Effects

Alternative D would have less broadcast spraying and more spot spraying, so there should be less potential for damaging or destroying non-target vegetation, but lower effectiveness in reducing invasives. We assume equal effectiveness between alternatives B and D for 1,386 acres (80% effective per year). Effectiveness would be reduced by half for the 738 acres that must be spot or hand treated. This reduces the overall effectiveness ranking for alternative D to 66%, meaning that about a third of the acreage would have to be retreated each year until target populations reach a maintenance level and can be restored.

Alternative D would use picloram. Picloram has the potential for adverse effects to livestock, but use of project design features and label restrictions would prevent impacts.

Table 15. Estimated acres of first choice herbicide use and potential effects

First choice herbicide	Estimated acres of spray Broadcast / spot	Potential effect
Chlorsulfuron	435 / 595	Non-target forage plants could be killed by drift or runoff. Off-site runoff of chlorsulfuron could be substantial in conditions that favor runoff. The available data are sufficient to assert that no adverse effects are anticipated in terrestrial animals that do not directly depend on the weeds that are targeted (SERA 2004).
Glyphosate	3 / 722	Non-target plants could be killed by drift or runoff. Ingestion of RoundUp or large amounts of freshly sprayed vegetation may cause temporary gastrointestinal irritation.
Metsulfuron methyl	69 / 238	Non-target forage plants could be killed by drift or runoff. Off-site runoff of metsulfuron methyl could be substantial in conditions that favor runoff. The available data are sufficient to assert that no adverse effects are anticipated in terrestrial animals that do not directly depend on the weeds that are targeted (SERA 2005).

Picloram	36 / 27	There are no clear organ-specific pathological effects are associated with picloram. But studies have shown nonspecific alterations in the staining properties of liver tissue with altered liver and kidney weights noted at higher doses. Picloram is persistent so has effects for longer periods of time (SERA 2011).

Issue indicators

1. *Type (rate, method, chemical properties) and extent of herbicide use that could result in harmful exposure scenarios to livestock*

   One first choice herbicide (picloram) used for alternative D would potentially have effects to livestock, including possible effects to liver and kidney tissues and weights. In general, low rates of herbicides would be used. Impacts would be prevented by the use of project design features and label restrictions.

2. *Amount of time and area where livestock may need to be restricted during and after herbicide use*

   When picloram is used, grazing would be eliminated during herbicide treatment until poisonous plants are dry and no longer palatable. Grazing animals used for meat should be removed from treated areas for 2 weeks after treatment and 3 days prior to slaughter

3. *Qualitative assessment of the effectiveness of buffers and other project design features to prevent harmful herbicide exposure scenario*

   Project design features are adequate to prevent harmful herbicide exposure to livestock. Permittees would be notified of herbicide application and would be required to abide by herbicide label restrictions.

3. *Assessment of treatment costs and effectiveness*

   Alternative D restricts available treatment methods for both the existing infestations and future detections and thus reduces its effectiveness. The loss of the ability to use aminopyralid in this alternative is estimated to reduce the effectiveness of treating about 1,347 acres. Because aminopyralid can be broadcast to the water’s edge, and other herbicides cannot, about 738 acres would have to be spot applied in alternative D, rather than broadcast. This would increase the time and thus the cost of treating these acres.

   The economic analysis assumes equal effectiveness between alternatives B and D for 1,386 acres (80% effective per year). It reduces the effectiveness by half for those 738 acres that must be spot or hand treated in alternative D (rather than broadcast sprayed). This reduces the overall effectiveness ranking for alternative D to 66%, meaning that about a third of the acreage would have to be retreated each year until target populations reach a maintenance level and can be restored.

   The most ambitious treatment scenario would treat all 2,124 acres within a year of this decision being signed (2014-2015 or Year 1). The following year, 34 percent of this acreage would still need to be treated and would be subject to annual spread. Under the most ambitious scenario Alternative D would take 4 years of treatment to reach maintenance levels of invasive plant infestations (37 acres). Treatment costs would be $598 per acre.

Cumulative Effects

Past, present and foreseeable future actions have and will continue to contribute to the establishment of invasive weeds. The following bulleted list summarizes many of the activities associated with invasive plant establishment and spread on Forest lands and adjacent ownerships.

- Past invasive plant management
- Recreational forest use
- Other ground disturbing activities such as construction or maintenance of recreation sites
- Road use and maintenance
- Fires and associated management activities
- Logging and thinning activities
- Agricultural crop production adjacent to forest boundary
- Grazing and dispersal of propagules by animals

Present and reasonably foreseeable future actions would continue to provide opportunities for invasive species to establish. Roads are generally considered a major conduit for invasive plants. (Trombulak and Frissell 2000), and given the amount of area associated with roads, they are likely to continue to be a major vector for invasive plant introduction and spread. Forest Service projections suggest that recreation uses of National Forests will continue to increase. Other land management and use of activities such as grazing, vegetation management, fuels management (Healthy Forest Initiative), wildfire, and fire suppression will continue to cause ground disturbances that can contribute to the introduction, spread and establishment of invasive plants on National Forest system lands (R6 FEIS 2005).

Cooperation with local partners such as other federal and state land management agencies, local service district, tribal governments, non-profit organization cooperative weed management areas and interested citizens would continue.

Tables 24 and 25 of the project EIS list ongoing and foreseeable future projects on the Malheur National Forest. Many of them would have little to no effect on livestock, range resources or permittees (culvert replacement, toilet repair). Some projects, such as spring development and reconstruction and extension of water troughs) would have beneficial effects. Some could have effects to management such as requiring temporary movement or restriction of livestock (prescribed burning and timber harvest).

Alternative A Cumulative Effects

There are no direct or indirect effects of alternative A and, therefore, no cumulative effects. Consequences of implementing alternative A are discussed under Environmental Consequences, Alternative A.

Alternative B - Cumulative Effects

Implementation of alternative B would gradually reduce the extent and abundance of invasive plant species on range allotments. The effectiveness of the proposed invasive plants treatment project would be increased if coordination with adjacent landowners treats invasive plants infestations across land ownerships. Alternative B would effectively control invasive infestations on the Forest. The likely result of this would be improved weed control effectiveness on adjacent land ownerships. That is, because aggressive treatment would reduce invasive infestations on the National Forest, there would be less weed seed and fewer invasive plants to spread onto neighboring lands. As the spread of invasive species on National Forest System lands decreases, the likelihood of weeds spreading onto private, tribal, state and other ownerships would also decrease. Over time, this could reduce herbicide use on National Forest and adjacent land ownerships.

Since grazing allotments cover essentially the entire Malheur National Forest, any activities that produce ground disturbance on the Forest may increase the spread of invasive plants and reduce the amount of forage available for livestock. Therefore, although treatments proposed under alternative B would reduce invasive infestations and all management activities follow guidelines to prevent or reduce the spread of weeds, new infestations or spread of remaining infestations would continue to occur. As a result, herbicide applications would likely continue to be needed over time. We expect, however, that after current infestations are reduced or eradicated with initial treatments, follow-up treatments and treatments of new infestations would require less herbicide over smaller areas. Herbicide treatment of invasive species on lands near or adjacent to the Forest would likely continue and amounts, types, and methods of application cannot be anticipated.

Given the short half lives, the low rates of application proposed and the minimal effects of the first choice herbicides proposed under alternative B, it is not likely that repeated applications in the same areas would have effects to livestock. Herbicide risk assessments consider chronic exposure and even under those scenarios, effects were below the established thresholds.

An effective treatment program requires vigilance to successfully treat weeds over the long term. The EDRR component of this alternative allows for treatment of newly discovered, future infestations on Forest lands. Other landowners may or may not have the flexibility, funds or manpower to address new infestations whenever and wherever they are found. Because the extent of future treatment programs on other lands is unknown, the effect this would have on weeds migrating onto national forest lands is also unknown.

Tables 25 and 26 of the EIS list projects and activities that are ongoing or foreseeable on the Malheur National Forest. Those projects do not involve weed treatment or herbicide use and generally would not overlap in time with herbicide treatments proposed under alternative B. Since no direct or indirect effects to livestock or range management are expected from alternative B, this project would not add to any effects from those projects and activities. Therefore, there would be no adverse cumulative effects to range resources from this project. In the long-term, treatment of invasive plants would favor re-establishment of desirable plant communities on the Malheur National Forest and across ownership boundaries where coordinated treatments occur.

Alternatives C and D – Cumulative Effects

Although invasive treatments are somewhat different among the three alternatives. the differences become miniscule when considered in the context of all cumulative effect factors that have, can and will influence invasive plant infestations and native plant communities.

Ongoing and foreseeable future projects do not involve weed treatment or herbicide use and generally would not overlap in time with herbicide treatments proposed under alternatives C and D. Since no direct or indirect effects to livestock or range management are expected from alternatives C and D, this project would not add to any adverse effects from those projects and activities. Therefore, there would be no adverse cumulative effects to range resources from alternatives C and D. In the long-term, treatment of invasive plants would favor re-establishment of desirable plant communities on the Malheur National Forest and across ownership boundaries where coordinated treatments occur.

Comparison of alternatives

Table 17 compares various elements of each alternative. All action alternatives (B, C, and D) would use integrated treatments to reduce invasive plant infestations. All would incorporate early detection and rapid response to quickly treat new infestations on the Forest. Alternatives B and D propose the more herbicide use than alternative C. Alternative B is expected to be 80 percent effective at reducing invasive plant infestations. Alternative D would be 80 percent effective for xxxx acres and 66 percent effective for 738 acres. Alternative C would be approximately 50 percent. Alternative A would be approximately 25 percent effective. Effectiveness of the alternatives provides a measure of the amount of time it would take to see reductions in invasive species and resulting restoration of native vegetation that provides forage for livestock use. The cost of alternatives may affect the amount of treatment that occurs in a given year and therefore also provides a measure of how long it would take to reduce invasive plant infestations and begin the restoration of native vegetation.

All action alternatives could have potential effects to grazing management activities such as timing of grazing and patterns of use. Alternative D would be most likely to affect grazing management operations since one of the first choice herbicides has label restrictions on grazing. Alternative D proposes the use of picloram which may have more effects to livestock. Alternative B includes aminopyralid as a first choice herbicide; aminopyralid has label restrictions for use of grass, hay, and straw treated with aminopyralid, but the restrictions do not apply to grazing. If herbicides other than the designated first choices are used, other label restrictions may apply. Use of label restrictions and project design features would eliminate effects to livestock.

Irreversible and Irretrievable Commitment of Resources

Implementing Alternative A (No Action) may eventually result in irretrievable impacts on grazing resources as weeds would continue to spread and invade in allotments. Since infestations currently cover a relatively small percentage of the Forest, it would likely take many years before they would get to an irretrievable state. Implementing Alternative B, with appropriate environmental protection would not result in irreversible or irretrievable loss of range resources. Implementation should result in a fairly rapid reduction of infestations and a gradual reduction in the amount of treatment needed. Implementing alternative C or D would require longer periods of time to control weeds on the Forest. As a result, infestations would continue to grow and spread, becoming harder to control or eradicate and more costly over time and gradually reducing desirable livestock forage.

Table 16. Comparison of alternatives

Activity	Alt A (No Action)[1]	Alt B (Proposed Action)	Alt C	Alt D
Authorizes EDRR	No	Yes	Yes	Yes
Non-herbicide treatments	Non-herbicide treatments would likely continue with categorical exclusions, connected actions, unassisted distribution of biological agents, and road work authorized by the state or county. [3]	Non-herbicide treatments would be integrated with herbicide treatments	Same as alternative B, except only non-herbicide treatments would be approved within 100 feet of water bodies	Same as alternative B
Maximum acres of proposed herbicide treatments during any year of implementation	0	2,124	1,654	2,124
Total invasive plant treatment acres over the life of the project (includes all treatments and re-treatments)	0	30,000	30,000 total, 24,810 herbicide	30,000
Number of herbicides available for use	0	11	10 (no picloram)	10 (no aminopyralid)
Malheur Forest Plan amendment to include aminopyralid	No	Yes	Yes	No
Herbicide application rate and method	None	Lowest effective rate, broadcast sprayers may be used where needed according to PDFs	Application rate would not exceed 70% of typical broadcast rate, no boom or broadcast sprayers	Same as alternative B
Indicator 1: Type and extent of herbicide use that could result in harmful exposure scenarios to livestock.	No herbicide use	First choice herbicides used for alternative B are expected to have no adverse effects to livestock.	First choice herbicides used for alternative C are expected to have no adverse effects to livestock. In later years if other	One first choice herbicide (picloram) used for alternative D would potentially have effects to livestock, including possible

[1] The analysis in Chapter 3 assumes No Action means no invasive plant treatments will occur. Prevention would continue, as would natural distribution of biological agents. We would likely continue to use non-herbicide methods with routine NEPA documentation.

Activity	Alt A (No Action)[1]	Alt B (Proposed Action)	Alt C	Alt D
			herbicides are used, some, because of their chemical properties (imazapic, clopyralid, triclopyr), have the potential for effects to livestock (table 13), but project design features.and lable restrictions would ensure that livestock are not exposed.	effects to liver and kidney tissues and weights. In general, low rates of herbicides would be used. Label restrictions and project design features would ensure that livestock are not exposed.
Indicator 2: Amount of time and area where livestock may need to be restricted during and after herbicide use.	No restrictions to grazing	None on livestock use for the first choice herbicides. Aminopyralid has restrictions for other uses of treated grass, hay and straw. Grazing restrictions with use of clopyralid, imazapic, picloram and triclopyr (table 13).	There are no restrictions on livestock use for the first choice herbicides. If other herbicides are used in later years, some may have restrictions, particularly clopyralid, imazapic, and triclopyr.	When picloram is used, grazing would be eliminated during herbicide treatment until poisonous plants are dry and no longer palatable. Grazing animals used for meat should be removed from treated areas for 2 weeks after treatment and 3 days prior to slaughter

Activity	Alt A (No Action)[1]	Alt B (Proposed Action)	Alt C	Alt D
Indicator 3: Qualitative assessment of the effectiveness of buffers and other project design features to prevent harmful herbicide exposure scenario.	No need for buffers or project design features	Following label restrictions and project design features would prevent harmful herbicide exposure scenarios for first choice herbicides. Other herbicides are inherently more likely to have adverse effects, but buffers and design features should prevent harmful exposures. Permittees would be notified of herbicide application and herbicide applicators would be required to follow herbicide label restrictions. Aquatic labeled herbicides would be used near water sources.	Project design features are adequate to prevent harmful herbicide exposure to livestock. Permittees would be notified of herbicide application and would be required to follow herbicide label restrictions. Under alternative C, buffers would restrict herbicide use on more acres and would restrict broadcast spraying, but would result in more mechanical or manual treatment in riparian areas.	One of the first choice herbicides (picloram) is inherently more likely to have adverse effects to livestock than first choice herbicides proposed under alternatives B and C. However, following label restrictions and project design features should prevent harmful exposure to livestock. Permittees would be notified of herbicide application and herbicide applicators would be required to follow herbicide label restrictions. Aquatic labeled herbicides would be used near water sources.
Indicator 4: Assessment of treatment costs and effectiveness	Treatments would be restricted to (1) the levels of biocontrol that currently exist or develop over time without new distributions and (2) roadside treatments under state and county jurisdiction.. Since many invasive infestations occur along roads, mechanical treatments (mowing), if timed to occur before seed set, could effectively control many infestations. Mechanical treatment would not be likely to eliminate infestations or reduce their size. Manual and mechanical methods on the	This alternative increases the number and kinds of tools for controlling invasive plants. It is expected that proposed treatments would be approximately 80 percent effective, so under the most ambitious scenario invasive infestations would be reduced over approximately 3 years to a maintenance level (23 acres). Treatment costs would be $544 per acre. Herbicide use would be reduced over time as infestations are eliminated or reduced in size. Native vegetation and forage would be expected to recover faster	This alternative reduces the number and kinds of tools for controlling invasive plants. It is expected that proposed treatments would be approximately 40 percent effective, so under the most ambitious scenario invasive infestations would be reduced over approximately 5 years to a maintenance level (59 acres). Treatment costs would be $722 per acre. Herbicide use would be reduced over time as infestations are eliminated or reduced in size. Native vegetation and forage recovery would be expected	This alternative increases the number and kinds of tools for controlling invasive plants. It is expected that some treatments would be approximately 66 percent effective () acres. Under the most ambitious treatment scenario, invasive infestations would be reduced over approximately 4 years to a maintenance level (37 acres). Treatment costs would be $598 per acre. Herbicide use would be reduced over time as infestations are eliminated or reduced in size. Native vegetation and forage

Activity	Alt A (No Action)[1]	Alt B (Proposed Action)	Alt C	Alt D
	Umatilla were calculated to be approximately 20 percent effective (Laufmann 2007). Biocontrols of Dalmatian and yellow toadflax appear to be effective at this time. If insects remain in place, biocontrols would continue to be effective.	under this alternative than under the other alternatives.	to be slower under this alternative than under the other two action alternatives. Since manual and mechanical treatments are labor intensive and costly, it is likely that they would not be accomplished as rapidly as anticipated under the most ambitious scenario. Even if all acres were treated, treatment effectiveness would still be low due to the difficulty of removing roots and rhizomes for many invasive species.	recovery would be expected to be intermediate between Alternative 2 and Alternative 3.

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Appendix A: Grazing Allotments

Table A-1. Number of sites and acres of weeds for each grazing allotment

Allotment Name	Status Active (A) Vacant (V)	District	Forest land allotment acres	Number of invasive species sites mapped	Number of target invasive species mapped in allotment	Invasive species acres*
ALDRICH	A	BM	20572	1	1	8
ALKALI	A	EC	26753	106	5	71
ALLISON	A	EC	21156	11	4	1.5
ANTELOPE (SILVIES)	A	BM	29381	7	5	1
ANTELOPE (UPPER MALHEUR)	A	PC	5512	2	1	0.14
AUSTIN	V	BM	672	4	3	9
BALANCE CREEK	A	BM	365	0	0	0
BEAR CREEK	A	BM	1532	9	3	18
BEECH CREEK	A	BM	3756	10	3	14
BIGGS ON/OFF	A	BM	166	0	0	0
BIG SAGEHEN	A	EC	21612	56	8	8
BLUE CREEK	A	EC	16738	39	7	6
BLUE MOUNTAIN	V	BM	22709	196	8	243
BLUEBUCKET	A	PC	23436	11	3	5
BRIDGE CREEK	A	EC	8354	13	3	1.5
BUCK MOUNTAIN	A	EC	41479	2	2	0.14
CALAMITY	A	BM	23204	66	6	25
CAMP CREEK (SILVIES)	A	BM	14958	10	4	13
CENTRAL MALHEUR	A	EC	11377	22	3	5
COUNTY ROAD	A	BM	0	0	0	0
CROOKED CREEK	A	BM	5076	10	3	1
DARK CANYON	A	BM	31808	40	9	5.29
DEADHORSE	A	BM	15527	5	4	0.52
DEARDORFF	A	PC	11927	24	4	11
DEER CREEK	A	BM	2998	2	2	0.21
DEVINE	A	EC	25390	146	6	26
DIXIE	A	BM	26875	14	5	2
DOLLAR BASIN	A	PC	16396	5	3	5

Allotment Name	Status Active (A) Vacant (V)	District	Forest land allotment acres	Number of invasive species sites mapped	Number of target invasive species mapped in allotment	Invasive species acres*
DONALDSON	A	BM	8008	14	5	10
DONNELLY	A	EC	56083	30	4	24
EMIGRANT CREEK	V	EC	1609	2	1	0.20
FAWN SPRING	A	BM	6615	18	6	4
FERG	A	BM	478	1	1	0.10
FIELDS PEAK	A	BM	30735	47	7	6
FLAG PRAIRIE	A	PC	28775	33	6	18
FLAGTAIL	A	BM	14978	19	6	32
FOX	A	BM	26589	63	7	30
FRENCHY	A	BM	525	0	0	0
GREEN BUTTE	A	EC	45265	9	4	2
HAMILTON	A	BM	3410	7	4	0.71
HANSCOMB	A	BM	9105	4	3	0.74
HERBERGER	V	BM	553	0	0	0
HIGHWAY	A	BM	905	0	0	0
HOT SPRINGS	A	PC	4693	0	0	0
HOUSE CREEK	A	EC	3252	15	3	1
HUGHET VALLEY	A	EC	1877	0	0	0
HUNTER CABIN	A	BM	15892	0	0	0
INDIAN CREEK	A	PC	2593	1	1	0.10
INDIAN RIDGE	A	BM	3440	20	8	2.50
IZEE	A	EC	22219	22	5	15
JACK CREEK	A	BM	10358	55	8	17
JOAQUIN	A	BM	38	0	0	0
JUSTICE	A	BM	825	0	0	0
KEENEY MEADOWS	A	BM	450	1	1	0.08
KOEHLER	A	BM	1002	0	0	0
KING	A	BM	2237	0	0	0
LAKE CREEK	V	PC	10195	15	5	7
LEWIS CREEK	A	BM	2604	0	0	0
LITTLE MOWICH	A	EC	317	0	0	0
LOGAN VALLEY	A	PC	3780	6	3	0.61
LONESOME	A	EC	32085	30	4	32
LONG CREEK	A	BM	50241	83	10	57
LOWER	A	BM	59120	195	12	247

Allotment Name	Status Active (A) Vacant (V)	District	Forest land allotment acres	Number of invasive species sites mapped	Number of target invasive species mapped in allotment	Invasive species acres*
MIDDLE FORK						
LOWER NICOLL	A	EC	3966	0	0	0
MCCLELLAN	A	BM	2814	1	1	0.10
MCCOY CREEK	A	PC	980	1	1	0.10
MCCULLOUGH	V	BM	627	5	2	13
MT. VERNON / JOHN DAY	A	BM	50466	58	7	27
MUDDY	A	EC	6621	13	3	1
MURDERERS CREEK	A	BM	67075	20	11	53
MYRTLE	A	EC	29407	32	5	7
NINETY SIX	A	BM	300	0	0	0
NORTH FORK	A	PC	31044	109	9	38
OTT	A	PC	29991	158	7	25
PEARSON	A	BM	190	0	0	0
PINE CREEK	A	EC	40328	222	4	81
POISON	A	BM	74	0	0	0
RAIL CREEK	A	PC	27135	2	2	0.20
RAINBOW	A	EC	30707	25	6	8
REYNOLDS CREEK	A	PC	24028	261	7	42
ROSEBUD	A	BM	6912	34	5	44
ROUNDTOP	A	BM	13708	44	7	12.5
SAWMILL	A	EC	21461	2	2	0.09
SAWTOOTH	A	EC	17724	43	7	237.1
SCATFIELD	A	EC	2327	0	0	0
SCOTTY CREEK	A	BM	35817	7	2	13
SENECA	A	BM	19321	23	6	2
SILVER CREEK	A	EC	34716	6	3	1
SILVIES	A	EC	8789	5	2	8
SLIDE CREEK	A	BM	25540	32	5	27
SMOKY	A	BM	9264	1	1	0.11
SNOW MOUNTAIN	A	EC	12362	26	7	2
SNOWSHOE	A	BM	6386	2	1	0.20
SPRING CREEK	A	PC	57772	60	6	39
STAR GLADE	A	PC	1999	0	0	0
STORY-FRY	A	EC	619	3	2	0.22

Allotment Name	Status Active (A) Vacant (V)	District	Forest land allotment acres	Number of invasive species sites mapped	Number of target invasive species mapped in allotment	Invasive species acres*
SUGARLOAF	A	BM	39879	43	10	6
SULLENS	V	PC	46426	316	7	171
SUMMIT PRAIRIE	A	PC	25369	42	7	15
UPPER MIDDLE FORK	A	BM	54808	218	13	338
VAN	A	EC	6684	15	3	11
WAR CANYON	A	BM	541	0	0	0
WEST MALHEUR	A	EC	22938	52	4	7
WEST MYRTLE	A	EC	8541	25	4	6.50
WILLIAMS PASTURE	A	BM	1146	0	0	0
WINDY POINT	V	BM	1306	0	0	0
WOLF MOUNTAIN	A	EC	31608	28	6	12
YORK	A	BM	929	5	2	1

Appendix B: Treatment Effectiveness by Method

Manual and Mechanical Treatments

Manual and mechanical treatments physically remove and destroy, disrupt the growth of, or interfere with the reproduction of invasive plants. These treatments can be accomplished by hand, hand tool (manual), or power tools (mechanical); and include pulling, grubbing, digging, hoeing, tilling, cutting, mowing, and mulching of the target plants. Thermal techniques such as steaming, super heated water and hot foam are also considered as viable treatments.

Manual methods can be effective on small infestations if the entire root is removed. With new, small infestations, hand pulling can be the easiest and quickest method. Even larger populations, though, can be controlled with hand pulling if the workforce is available. One method consists of hand weeding selected small areas of infestation in a specific sequence, starting with the best stands of native vegetation (those with the least extent of infestation) and working towards stands with the worst infestation.

Manual methods are usually not as effective for deep-rooted or rhizomatous perennials such as leafy spurge where hand-pulling and hoeing often leave root fragments that can generate new plants. Hand-pulling or hoeing also disturbs the soil surface, which may increase susceptibility of a site to reinvasion by weeds. Manual methods are labor-intensive and usually ineffective for the treatment of large, well-established infestations of perennial invasive plants with long term viable seed such as knapweeds (Tu et al. 2001). Local efforts where larger community support or funding for hand crews exists does show promise, if efforts can be sustained.. Manual and mechanical methods as primary methods prior to the use of herbicides were shown to be only 25 % effective on the Umatilla National Forest (Erickson 2006).

The Nature Conservancy reported success with the use of manual control. (Tu et al. 2001). Hand pulling by volunteers has successfully controlled diffuse knapweed in the Tom McCall Preserve in northeast Oregon. Yellow bush lupine (*Lupinus arboreus*) was also controlled in coastal dunes in California by pulling small shrubs by hand. Larger shrubs were cut down with an ax, and re-sprouting was uncommon (Pickart and Sawyer, 1998). Hand pulling has also been fairly successful in the control of small infestations of thistles, white and yellow sweetclover, and purple loosestrife at TNC preserves scattered across the country.

Mowing or cutting is more effective on tap-rooted perennials such as spotted knapweed compared to rhizomatous perennials (Tu et al. 2001). Cutting or mowing plants can reduce seed production if conducted at the right growth stage. For example, a single mowing at late bud growth stage can reduce the number of seeds produced on annual plants. Mowing can also weaken an invasive plant’s competitive advantage by depleting root carbohydrate reserves, but mowing must be conducted several times a year for consecutive years to reduce the competitive ability of the plant.

Oregon Department of Agriculture staff compared mowing and pulling mature plants to no treatment in two western Oregon spotted knapweed infestations. They applied one treatment annually at the optimum time for each of four consecutive years, and concluded that neither method was effective in reducing population density or cover. They recommend consideration of pulling and mowing only where the goal is to contain spotted knapweed infestations or to suppress seed production (Isaacson et al. 1997 in USDA 2005b Appendix J).

Because invasive plants flower throughout the summer, it is difficult to time mechanical treatments to prevent flowering and seed production. Repeated mechanical treatment too early in the growing season can result in a low growth form that is still capable of producing flowers and seed (Benefield et al. 1999). Mechanical treatments on some rhizomatous weeds, such as leafy spurge, can encourage sprouting and result in an increase in stem density (USDA Forest Service 2012c).

Mulching with plastic or organic materials can be used on relatively small areas (less than 0.25 acre), but will also stunt or stop growth of desirable native species. Mulching prevents seeds and seedlings from receiving sunlight necessary to survive and grow, and can smother some established invasive plants. Hay mulch was used in Idaho to reduce flowering of Canada thistle (Tu et al., 2001), but most rhizomatous perennial invasive plants cannot be controlled by this method or by shading because extensive root reserves allow regrowth through and around mulch or shade materials.

Thermal techniques are being tested or used with some success throughout Region Six by such agencies as Oregon Department of Transportation (ODOT), the Nature Conservancy and the Bureau of Land Management (BLM). The Nature Conservancy (Tu et al, 2002) tested the Eco-Weeder, an infrared technology device that uses the combustion of liquid gas to reach extremely high temperatures that place intense radiation directly on weeds to explode plant cells. The tool could be useful for small area treatments, especially on sidewalks, but the effectiveness on deep-rooted plants, sedges or rhizomatous grasses may not be as high. The Nature Conservancy also tested hot water pressure washers. The brand tested could apply hot water through a pressure nozzle with a wide spray or intense stream which would act as an injection device for below ground portions of plants. They found it effective on seedlings and annual plants within reach of the washer, but the effectiveness on plants with extensive underground roots or rhizomes would be less. Hot foam has been tested by the Nature Conservancy and used by the BLM effectively on puncturevine and slender false brome. Again, this technique is limited to the reach of the foam generator, but is an excellent non-chemical method. It is effective on seedlings and annuals and can be applied under weather conditions including wind and light rain.

Biological Control

Biological control can be defined as the use of natural enemies to reduce the damage caused by invasive plant populations. Biocontrol is often viewed as a progressive and environmentally friendly way to control pest organisms because it leaves behind no chemical residues that might have harmful impacts on humans or other organisms, and when successful, it can provide essentially permanent, widespread control with a very favorable cost-benefit ratio. Biological control is potentially useful where: eradication is not possible, sites are too large to be sprayed with herbicides, the invasive plant species is so abundant that other methods would not be practical, the biological control agent is effective on the target plant species and reduces or eliminates the need to use herbicides. The time frame for controlling invasives using biocontrols is very long, and agents would likely spread throughout the forest where food sources are available.

Stem weevil biocontrol agents have proven very successful for Dalmation toadflax control on infested forest and adjacent landowership sites on the forest. Several biocontrol agents are available for yellow starthistle and diffuse knapweed and effectiveness appears to be higher when biocontrol agents work in concert. However, where fire has entered into yellow starthistle sites, biocontrol agents appear to be less effective, likely a result of biocontrol population dynamics, impacts from fire and available food source. Biocontrol agents for control of purple loosestrife have been released on the Idaho side of the Snake river, however, the fluctuating water levels have negatively affected the establishment of a productive biocontrol population and effectiveness is minimal . Bio-control agents previously released on private lands and established on the Forest will continue to spread to other nearby invasive sites providing a potential long-term control treatment.

Herbicide Treatments

The objectives of herbicide treatments are often twofold: 1) to more efficiently reduce the size of moderate to large infestations of invasive plants to a point at which they can be hand-pulled or manual or mechanical methods are ineffective due to invasive plant growth morphology, or, 2) more efficiently treat large expansive areas where invasive plants thrive due to the nature of the site. Different herbicides vary in effectiveness and length of control on different invasive plants, and herbicide techniques can vary in effectiveness, environmental effects, and costs.

Herbicides vary in selectivity of control for various plant groups. Those differences in selectivity are the basis for developing effective plant control treatments while minimizing adverse effects and facilitating native plant community maintenance or restoration.

Just as changes in plant diversity or species composition can occur due to invasive plants, changes can also occur due to treatments. Short-term changes in species dominance can lead to long-term shifts in plant community composition and structure. Repeated treatments over time could favor tolerant species, which in turn could shift pollinators available to a community. Continuous broadcast use of one or a combination of herbicides will often select for herbicide tolerant plant species. When broadleaf selective herbicides are used, noxious annual grasses such as medusahead, cheatgrass or barbed goatgrass may become dominant. Population shifts through repeated use of a single herbicide may also reduce plant diversity and cause nutrient changes. Alternatively, plant diversity is reported to be maintained on sites with repeated applications of picloram and chopyralid for control of spotted knapweed in Montana (Rice 2000). Additionally, analyses based on 60 published studies of terrestrial plants and animals in temperate zone forests and agro-ecosystems indicate species richness and diversity of vascular plants was either unaffected or increased (particularly herbaceous species) in response to glyphosate (Sullivan and Sullivan 2003). It is obvious there are still unanswered questions related to recovery of native vegetation after herbicide treatment. Project design features such as the development of a long-term site strategy, monitoring, and restoration would be directed towards sites that could experience repeated herbicide applications (i.e. areas where recovery to native vegetation may not be possible such as campgrounds, highly disturbed areas). It is likely that due to the nature of repeated disturbance activities in some areas on the forest, long-term site objectives may be focused on containment of these areas to prevent future spread into other areas of the forest and a fully restored native plant component is not attainable. In these cases, desirable vegetation that reduces the potential for invasive plant re-establishment and protects other resources such as soil and water is likely.

Cultural Treatments

Cultural methods of invasive plant management are generally targeted toward enhancing desirable vegetation to minimize invasion. Common cultural treatments include planting or seeding desirable species to shade or out-compete invasive plants, applying fertilizer to desirable vegetation, and controlled grazing (no grazing is proposed in this EIS).
Native plant species usually do not out-compete invasive plants in disturbed habitat. Herbicide application after invasive plants have emerged, followed by tillage and drill seeding, can be effective in establishing desirable species on some sites (Sheley et al. 1999a). This process, however, can lead to increased soil compaction (DiTomaso 1999),

and cannot be conducted on steep, remote, or rocky sites. Seeding risks introduction of non-native and/or invasive species, but use of certified weed-free seed reduces this risk. Ground disturbing activities that would include disking or use of heavy equipment for revegetation would require separate NEPA analysis. Cultural treatments that have been used on the Malheur National Forest include grazing and solarization (for small patches of leafy spurge). Cultural treatments including the addition of fertilizer/soil amendments, and/or competitive planting may occur on future unknown sites.

Manual and Mechanical Treatments

Manual and mechanical treatments physically remove and destroy, disrupt the growth of, or interfere with the reproduction of invasive plants. These treatments can be accomplished by hand, hand tool (manual), or power tools (mechanical); and include pulling, grubbing, digging, hoeing, tilling, cutting, mowing, and mulching of the target plants. Thermal techniques such as steaming, super heated water and hot foam are also considered as viable treatments.

Manual methods can be effective on small infestations if the entire root is removed. With new, small infestations, hand pulling can be the easiest and quickest method. Even larger populations, though, can be controlled with hand pulling if the workforce is available. One method consists of hand weeding selected small areas of infestation in a specific sequence, starting with the best stands of native vegetation (those with the least extent of infestation) and working towards stands with the worst infestation.

Manual methods are usually not as effective for deep-rooted or rhizomatous perennials such as leafy spurge where hand-pulling and hoeing often leave root fragments that can generate new plants. Hand-pulling or hoeing also disturbs the soil surface, which may increase susceptibility of a site to reinvasion by weeds. Manual methods are labor-intensive and usually ineffective for the treatment of large, well-established infestations of perennial invasive plants with long term viable seed such as knapweeds (Tu et al. 2001). Local efforts where larger community support or funding for hand crews exists does show promise, if efforts can be sustained.. Manual and mechanical methods as primary methods prior to the use of herbicides were shown to be only 25 % effective on the Umatilla National Forest located adjacent to the Wallowa Whitman National Forest (Erickson, 2006).

The Nature Conservancy reported success with the use of manual control. (Tu et al., 2001). Hand pulling by volunteers has successfully controlled Centaurea diffusa (diffuse knapweed) in the Tom McCall Preserve in northeast Oregon. Yellow bush lupine (*Lupinus arboreus*) was also controlled in coastal dunes in California by pulling small shrubs by hand. Larger shrubs were cut down with an ax, and re-sprouting was uncommon (Pickart and Sawyer, 1998). Hand pulling has also been fairly successful in the control of small infestations of *Centaurea* spp. (thistles), *Melilotus officinalis* (white and yellow clover), and *Lythrum salicaria* (purple loosestrife) at TNC preserves scattered across the country.

Manual tools such as the Weed Wrench (www.weedwrench.com) can be used on herbaceous plants that have a stem or bundle of stems strong enough to withstand the crush of the jaws. It has been used successfully to pull acacia (*Acacia melanoxylon*), buckthorn (*Rhamnus cathartica*), Russian olive (*Elaeagnus angustifolia*), multiflora rose (*Rosa multiflora*), willow (*Salix* spp.), tamarisk (*Tamarix* spp.), bush honeysuckles (*Lonicera* spp.), Scotch broom (*Cytisus scoparius*), French broom (*Genista monspessulanus*), and Brazilian pepper (*Schinus terebinthifolius*) at preserves across the mainland U.S. In Hawaii, the Weed Wrench has been used to pull

Strawberry guava (*Psidium cattleianum*) and small saplings of Karaka nut (*Corynocarpus laevigatus*) from the Kamakou preserve on Molokai (Hawaii) (Tu et al, 2001).

Mowing or cutting is more effective on tap-rooted perennials such as spotted knapweed compared to rhizomatous perennials (Tu et al. 2001). Cutting or mowing plants can reduce seed production if conducted at the right growth stage. For example, a single mowing at late bud growth stage can reduce the number of seeds produced, especially for annuals. If soil moisture is adequate, some species, such as diffuse knapweed, can actually produce more seeds after mowing (Sheley et al. 1999b). Mowing can also weaken an invasive plant's competitive advantage by depleting root carbohydrate reserves, but mowing must be conducted several times a year for consecutive years to reduce the competitive ability of the plant.

Because invasive plants flower throughout the summer, it is difficult to time mechanical treatments to prevent flowering and seed production. Repeated mechanical treatment too early in the growing season can result in a low growth form that is still capable of producing flowers and seed (Benefield et al. 1999). Mechanical treatments on some rhizomatous weeds, such as leafy spurge, can encourage sprouting and result in an increase in stem density (USDA Forest Service 2012c).

Mulching with plastic or organic materials can be used on relatively small areas (less than 0.25 acre), but will also stunt or stop growth of desirable native species. Mulching prevents seeds and seedlings from receiving sunlight necessary to survive and grow, and can smother some established invasive plants. Hay mulch was used in Idaho to reduce flowering of Canada thistle (Tu et al. 2001), but most rhizomatous perennial invasive plants cannot be controlled by this method or by shading because extensive root reserves allow regrowth through and around mulch or shade materials.

Thermal techniques are being tested or used with some success throughout Region Six by such agencies as Oregon Department of Transportation (ODOT), the Nature Conservancy and the Bureau of Land Management (BLM). The Nature Conservancy (Tu et al 2002) tested the Eco-Weeder, an infrared technology device that uses the combustion of liquid gas to reach extremely high temperatures that place intense radiation directly on weeds to explode plant cells. The tool could be useful for small area treatments, especially on sidewalks, but the effectiveness on deep-rooted plants, sedges or rhizomatous grasses may not be as high. The Nature Conservancy also tested hot water pressure washers. The brand tested could apply hot water through a pressure nozzle with a wide spray or intense stream which would act as an injection device for below ground portions of plants. They found it effective on seedlings and annual plants within reach of the washer, but the effectiveness on plants with extensive underground roots or rhizomes would be less. Hot foam has been tested by the Nature Conservancy and used by the BLM effectively on puncturevine and slender false brome. Again, this technique is limited to the reach of the foam generator, but is an excellent non-chemical method. It is effective on seedlings and annuals and can be applied under weather conditions including wind and light rain.

Spring vs. Fall Treatments

Both spring and fall treatments have advantages and disadvantages. Fall treatments have less effect on non-target forbs. Climatologically, the weather is more consistent in the fall, but may be consistently too cold, especially in the morning. A drawback is that there is greater annual variability in the fall treatment window. It is difficult to know (and plan) when the fall treatment window will arrive. On some years there may be no fall treatment window due to warm weather and no rainfall. If it does arrive, it may last only a week or as long as several weeks. The end of the fall window can arrive abruptly with the snowfall and cold windy weather.

The spring treatment window is relatively long and dependable in terms of start and end date and falls at a time when you know and can plan for budget and staff. The days are longer in the spring, which allows more application time (and acres) each day. Late sunset gives application operations the option of shutting down midday if the wind comes up and resuming in the evening when the wind dies down. Both seasons can conflict with aircraft availability as a result of prescribed burning or wildfires.